OPERATOR'S MANUAL

TM-102700

VOLUME 1

POWER-LINE DISTURBANCE ANALYZER

SERIES 606

PLEASE NOTE

New Street Address and Telephone #:

DRANETZ SERVICE CORPORATION

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DRANETZ®

WARNING

Because of possible shock or fire hazards, connection to this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

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NOTE

Refer to Volume 2 (Service Manual) of TM-102700 for maintenance data and factory service information.

This equipment is manufactured under U. S. Patent Number 3,549,874 — Dranetz Technologies, Inc. 08818

Revised 15 September 1984

DRANETZ

DRANETZ TECHNOLOGIES, INCORPORATED
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STATEMENT OF WARRANTY

ALL PRODUCTS OF DRANETZ TECHNOLOGIES INC ARE WARRANTED TO THE ORIGINAL PURCHASER AGAINST DEFECTIVE MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM THE DATE OF DELIVERY. DRANETZ WILL REPAIR OR REPLACE, AT ITS OPTION, ALL DEFECTIVE EQUIPMENT RETURNED, FREIGHT PREPAID, DURING THE WARRANTY PERIOD, WITHOUT CHARGE FOR REPAIR, PROVIDED THERE IS NO EVIDENCE THAT THE EQUIPMENT HAS BEEN MISHANDLED OR ABUSED.

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

This volume of the manual provides operating instructions for the Series 606 Power-Line Disturbance Analyzer (hereinafter referred to as the Analyzer), manufactured by Dranetz Technologies, Incorporated, Edison, New Jersey. Volume 2 contains the maintenance instructions for the Analyzer. This section describes the purpose, application and technical characteristics of the Analyzer. (See figure 1-1.)

1-2. PURPOSE

The Analyzer is an electronic solid-state portable instrument designed to monitor both short and long term power line disturbances. Capable of continuous unattended operation, the computer-controlled unit stores, analyzes, classifies, and prints out quantitative and qualitative disturbance data. Accompanying the data is a printout of time derived from a highly accurate crystal controlled 24-hour clock.

The Analyzer contains three independent measurement channels for monitoring up to three power lines whose RMS values may range from a low value of approximately 58 volts to as high as 600 volts (switch selectable in three broad ranges). A single channel Analyzer is also available.

The Analyzer classifies all noise disturbances into three categories; slow average, sag/surge, or impulse. The threshold value of each type of disturbance, above which detection and printout occurs, is operator selectable. Except for an automatic summary printout at the end of each day, printout normally occurs only when disturbances occur (or upon operator demand). Whenever a disturbance threshold is exceeded, a relay closure on the rear panel occurs. In an alternate mode, only a disturbance data summary printout occurs at the end of each day. These features permit long term unattended operation.

1-3. APPLICATIONS

The Analyzer provides the capability of monitoring and evaluating power system performance. Among its typical applications are the following:

a. To determine the effect of power systems operation on equipment malfunction. The time-referenced power fault disturbance record produced by the Analyzer permits rapid correlation of errors, outages, and equipment damage in computer, industrial process controls, digital communications equipment, medical monitoring apparatus, and so forth, to power line faults.

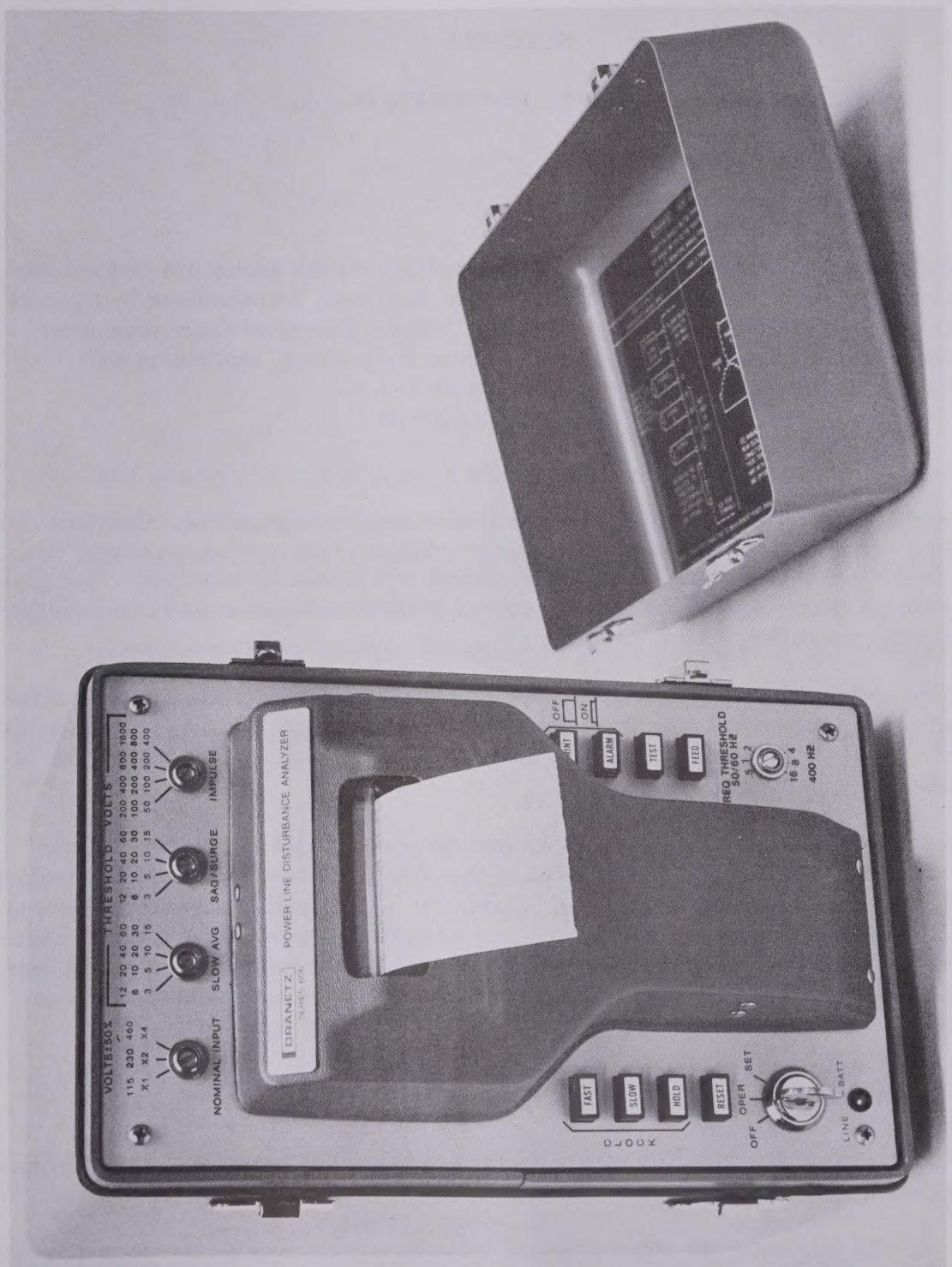


Figure 1-1. Series 606 Power-Line Disturbance Analyzer

b. To perform pre-installation site surveys. The Analyzer can be used to determine the adequacy of existing power lines intended to support critical electrical equipment. Anticipation of power problems saves time, money, and future trouble.

c. For diagnostic evaluation of power system performance. The portable Analyzer, particularly well suited for field use, is an ideal instrument for determining the probable causes of, and remedies for, power line disturbances.

d. For monitoring life test racks. The printout produced by the Analyzer provides a clear record of the quality of power supplied during unattended periods.

1-4. EQUIPMENT CHARACTERISTICS

The characteristics of the Analyzer are specifically designed to meet the requirements of power system applications. The portable instrument is small and lightweight, equipped with a carrying handle and rubber feet, and is capable of fitting under commercial airline seats. A rugged aluminum case, combined with sturdy internal construction, prevents damage to the unit during transport. The Analyzer is entirely self contained, requiring no ancillary equipment. As shown in figure 1-1, all controls and indicators are conveniently grouped around the thermal printer. Printout on the 2-1/4" wide paper is in plain language, in large easy-to-read print. Printer operation is switched to a paper conserve mode when the internal paper supply is low. The detailed specifications of the Analyzer are presented in Table 1-1.

TABLE 1-1. SERIES 606 ANALYZER SPECIFICATIONS

MODELS AVAILABLE

606-1:	Single channel (2-wire, 50 or 60 Hz) power line monitor
606-3:	Three channel (3 pairs, 2-wire, 50 or 60 Hz) power line monitor

Range Designation (Color Coded)	Nominal Input (V_{RMS})*	Maximum Impulse ** (V_{0-PK})	Input Impedance
X1	115	1000	100 kilohms
X2	230	2000	200 kilohms
X4	460	4000	400 kilohms

PRINTOUT DATA TYPES:

Slow-Averaging - Slow steady-state changes in monitored line voltage (approximate settling time: 10 seconds).

* Monitoring range for Sag/Surge and Slow Average measurements is ±50% of nominal value.

** Maximum voltage for impulses with effective duty cycle less than 1%.

TABLE 1-1. SERIES 606 ANALYZER SPECIFICATIONS (cont)

Sag/Surge - Cycle to cycle changes in RMS line voltage inputs.

Impulse - Peak reading of impulse (after filtering out line voltage waveform) having duration between 0.5 and 800 μseconds.

THRESHOLD VOLTAGE (SWITCH SELECTABLE):

Disturbance/ Printout Desig.	X1 (115V) Range (volts)	X2 (230V) Range (volts)	X4 (460V) Range (volts)
Slow Average (RMS AVG+ or AVG-	*3,5,10,15	*6,10,20,30	*12,20,40,60
Sag/Surge (RMS) (SAG or SURGE)	3,5,10,15	6,10,20,30	12,20,40,60
Impulse (Peak, without carrier)(IMPULSE)	50,100, 200,400	100,200, 500,800	200,400 800,1600

ACCURACY (ALL THREE INPUT VOLTAGE RANGES):

Slow Average: at 60 Hz, ±1% of reading ±1% of nominal input[/]
Sag/Surge: at 60 Hz, ±1% of reading ±1% of nominal input[/]

Impulse: ±5% of reading ±1% of maximum impulse, calibrated with a positive going, 10 μsec., half sinewave impulse. Typically add ±1dB, 10 μsec. to 50 μsec., or ±6dB, 0.5 μsec. to 800 μsec. (independent of grounding or polarity.)

[/] Based on sine wave signals. To maintain this accuracy Dranetz Engineering Laboratories recommends: (a) functional check every month, (b) calibration check every six months, (c) recalibration every year.

* Certain early units have 2 volt (4 volts for X2 range, 8 volts for X4 range) threshold markings. The actual threshold voltages are 3 volts (6 volts for X2 range, 12 volts for X4 range) despite this marking. Wherever a reference is made to the 3 volt (6 volts for X2 range, 12 volts for X4 range), it should be understood to mean the 2 volt (4 volts for X2 range, 8 volts for X4 range) markings for these units.

TABLE 1-1. SERIES 606 ANALYZER SPECIFICATIONS (cont)

TIME CLOCK:

Controlled by internal crystal oscillator. Crystal stability ±25 PPM (approx. ± 2 seconds/day). Clock can be set to within 1 second with front panel CLOCK pushbuttons. Key switch prevents alteration of clock setting during normal instrument operation.

AUDIBLE ALARM:

Built-in audible alarm which may be disabled or placed in 1 second signal duration mode by ALARM pushbutton.

OPERATION FROM DISTURBED LINES:

Operates properly with disturbances on its own power line over specified measuring ranges of impulses, sags and surges[#]. Also operates properly during line interruptions of up to approximately 0.5 seconds. Unit switches to internal batteries if line interruption exceeds approximately 0.5 seconds. At this time, POWER OFF message and time are printed; clock and memories are maintained for up to 4 hours. After 10 full seconds of restored power, POWER ON message and time are printed, and instrument shifts back to normal operation.

INPUTS MONITORED (barrier terminal board connections on rear panel):

Model 606-1: Single transformer-isolated input, 2-wire, 50 or 60 Hz.
Model 606-3: Three transformer-isolated inputs, 3 pairs 2 wire, 50 or 60 Hz.

STEADY STATE POWER REQUIREMENTS:

90 to 140 volts, 45-450 Hz, single phase (120-170 Volts, DC), 1.0 amperes maximum

ALARM RELAY CONTACT RATING:

24V AC or DC at 100 mA max, noninductive.

DIMENSIONS:

11"H x 8"W x 9-1/2"D
(28 cm H x 18 cm W x 24 cm D)

NOTE: An optional 19" rack mount with dust covers is also available.

WEIGHT:

Approximately 16 lbs typ. (7.3 kg)
Shipping weight - 20 lbs typ. (9 kg)

[#]Surges limited to 140 volts RMS

1-5. OPTIONS AND ACCESSORIES

a. Option 101 (available on Model 606-3 only): Under/over frequency monitoring on input channel (phase) A, with selectable thresholds of ±1/2 Hz, ±1 Hz, and ±2 Hz: 0.25 Hz accuracy.

b. Option 102: Power operation from 180 to 260 volts, 45-65 Hz, single phase.

c. Option 103 (available only with Option 101): Designed to measure and monitor 50, 60, and 400 Hz power lines. Internal switch is used to change monitor range from 45-65 Hz to 380-450 Hz. For 400 Hz, frequency thresholds are ±4 Hz, ±8 Hz, and ±16 Hz, with ±2 Hz accuracy.

NOTE: For 400 Hz use, the sag/surge magnitude measurement is accomplished by integrating the voltage over 8 cycles of the AC power. Duration measurements are made with 8 cycle resolution. The printout must be interpreted accordingly.

d. Option 104: Includes optical coupled time mark circuit which causes Model 606 to print a time mark when externally supplied DC voltage appears at the terminal board. This option is useful in providing time correlation with an external event.

Specifications

Input Voltage:	5 to 12 V DC
Input Current:	4 mA @ 5V typical 22 mA @ 12V typical
Timing:	Operates on leading edge of applied voltage
Pulse Width:	100 uSec minimum
Pulse Rate:	1 per second
Off Period:	500 uSec minimum

e. Option 105: Provides the interface that permits Model 606 to communicate with external adapter devices such as 606-PA-6001, -6002, -6003, and -6004. For operation with these adapters, refer to TM-103161. (For instructions on cable connections, see paragraph 2-13.)

f. Option 106: RS232C data output. (See instructions in paragraph 2-14.)

g. Model 604A Disturbance Simulator: Portable, calibrated disturbance simulator to produce sags, surges, impulses, and slow variations in RMS voltage for rapid performance check of the Model 606 in the field or test laboratory.

h. Model K103 Test Kit: Contains the Model 604A and a set of programmed memories for exercising the computer to facilitate troubleshooting and maintenance. Card puller and extender card are also included.

i. Model 910 Uninterruptible Power Supply: Designed to operate Series 606 continuously and to carry it through complete source-power interruptions of up to 2 hours without degrading operation. Operates properly with disturbances on its own power line over specified measuring ranges of impulses, sags, and surges.

j. Printer Paper (P/N 102714): Thermal paper approximately 140 feet by 2-1/4" rolls (2.5 inch diameter). Three spare rolls supplied with instrument.

k. Cleaning Paper (P/N 103418): One roll supplied with instrument.

1-6. STANDARD ACCESSORIES (SHIPPED WITH ALL UNITS)

a. 115 Volt line cord P/N 104943

b. Three (3) rolls of printer paper P/N 102714

c. One (1) roll of printer cleaning paper P/N 103418

d. Instruction Manual TM-102700

1-7. FACTORY REPAIR

When factory repair is desired, proceed as follows:

1. Contact the Dranetz Technologies Customer Service Department and obtain an Authorization Number.

2. Fill out the Repair/Service Order enclosed in this manual and ship it with the equipment to the Customer Service Department.

CUSTOMER SERVICE DEPT.
DRANETZ TECHNOLOGIES, INC.
2385 S. CLINTON AVE. (BLDG 1)
SOUTH PLAINFIELD, N.J. 07080

REPAIR/SERVICE ORDER

TEL: (201) 287-2535
(201) 287-3680
TWX: (710) 997-9553
CABLE: DRANETZ

NOTE: THIS COMPLETED FORM MUST ACCOMPANY RETURNED EQUIPMENT

CUSTOMER SHIPPING & BILLING INFORMATION

CUSTOMER P. O. # _____ P. O. DATE _____

SHIP TO: _____ INVOICE TO: _____

In Continental U. S., material will be returned by Dranetz to you by UPS, UPS Blue or other carrier chosen by Dranetz unless otherwise designated.

EQUIPMENT BEING RETURNED

Date of Original Purchase: _____ Original P. O. # _____

Model No. _____ S/N _____

Model No. _____ S/N _____

Ancillary equipment also being returned (If you neglect this, these items may not be returned to you).

☐ Power & Other Cables _____ ☐ Instr. Book _____

☐ Plug-ins (incl. S/N) _____ ☐ Connectors _____

☐ Other _____

RETURN AUTHORIZATION

Have you discussed the problem with Dranetz Sales or Service personnel?

Dranetz Return Authorization # _____

By: _____

If so, with whom _____ Date: _____

Whom should the Dranetz Customer Service Dept. contact for technical questions?

_____ ( )

NAME (Print) DEPARTMENT TELEPHONE

DESCRIPTION OF PROBLEM

Please be detailed, explicit and complete. Include test data, if this helps to describe the problem.
IMPORTANT: Repairs cannot be made unless this section is completely filled out.
(Attach added sheets if necessary)

_____

_____

_____

_____

CHECK WHERE APPLICABLE: IS MALFUNCTION RELATED TO: Warmup ☐ Temperature ☐

Intermittency ☐ Mechanical Handling ☐ Visual Defects ☐ Grounding ☐ Test Data Attached ☐

INITIATOR OF THIS ORDER

NAME/TITLE SIGNATURE TELEPHONE

(SEE OTHER SIDE FOR INSTRUCTIONS)

IMPORTANT (SEE OTHER SIDE FOR INSTRUCTIONS)

IMPORTANT (ENCLOSE THIS ENTIRE FORM WITH EQUIPMENT)

INSTRUCTIONS FOR REPAIR ORDER - DRANETZ TECHNOLOGIES

IMPORTANT: FOLLOW INSTRUCTIONS & USE THIS FORM. IT IS DESIGNED TO HELP US HELP YOU.

1. Before returning equipment to our factory, call our Customer Service Department, Tel:(201) 287-2535 Give the model No., serial number, and information on the problem.

   A. Our specialists may be able to solve your problem rapidly without equipment return.

   B. If equipment return is needed, you will be supplied with appropriate instructions and authorization information to expedite service.

2. If return is to be made,

   A. Fill out the other side of this form COMPLETELY.

   B. Enclose original of form INSIDE the shipping carton, preferably attached by masking tape to the equipment.

   C. Ship prepaid (including insurance); we will return prepaid unless otherwise advised by you.

   D. IMPORTANT - PACK PROPERLY! SHIPPING DAMAGE WILL BE CHARGED TO YOU!

NOTE:

Statement of Warranty - All products of Dranetz Technologies, Inc. are warranted to the original purchaser against defective material and workmanship for a period of one year from the date of delivery. Dranetz will repair or replace, at its option, all defective equipment returned, freight prepaid, during the warranty period, without charge for repair, provided there is no evidence that the equipment has been mishandled or abused.

FILL OUT OPPOSITE SIDE OF THIS FORM AND RETURN WITH EQUIPMENT.

SECTION II

INSTALLATION AND OPERATION

2-1. GENERAL

This section contains the installation and operating procedures for the Analyzer. The functions of all operating controls and indicators are provided and the various printouts produced by the Analyzer are described in detail. Refer to Appendix A for additional disturbance data and printouts.

CAUTION: When connecting this instrument, be sure ground connections are completed. If a power cord extension is used, it must be an approved 3-wire grounding type. Loss of ground connection presents a shock hazard.

NOTE: Current Analyzer Models use a new thermal printer assembly (Dranetz P/N 103600), described in the main body of this manual. Information covering an earlier printer assembly (Dranetz P/N 102889) is included for reference in Appendix B.

2-2. UNPACKING

Carefully open upper end (as marked) of shipping carton. All accessories (three rolls of paper, instruction manual, and any optional equipment) are packed in a small compartment at the top of the carton. Remove accessories and packaging material, then lift cardboard insert to expose the Analyzer which is shipped in the upright position. Grasp the carrying handle and pull the instrument straight up and out of the container.

Inspect the unit for possible damage incurred during transit. IF DAMAGE EXISTS, NOTIFY CARRIER AND DRANETZ TECHNOLOGIES, INC., AND RETAIN SHIPPING CARTONS AND ALL PACKING MATERIAL. DO NOT RETURN UNIT WITHOUT INSTRUCTIONS FROM MANUFACTURER.

2-3. OPERATING CONTROLS AND INDICATORS

The functions of all front panel operating controls and indicators are presented in Table 2-1. All referenced items are shown in figure 2-1.

TABLE 2-1. OPERATING CONTROLS AND INDICATORS

Index No.	Controls or Indicators	Function
1	NOMINAL INPUT switch	Sets nominal range of monitored voltage to 115 volts (X1), 230 volts (X2) or 460 volts (X4) RMS (±50%).
2	THRESHOLD VOLTS-SLOW AVG switch	Selects one of four threshold voltage values for slow average disturbances. Range in effect corresponds to setting of NOMINAL INPUT switch (correlated by color).

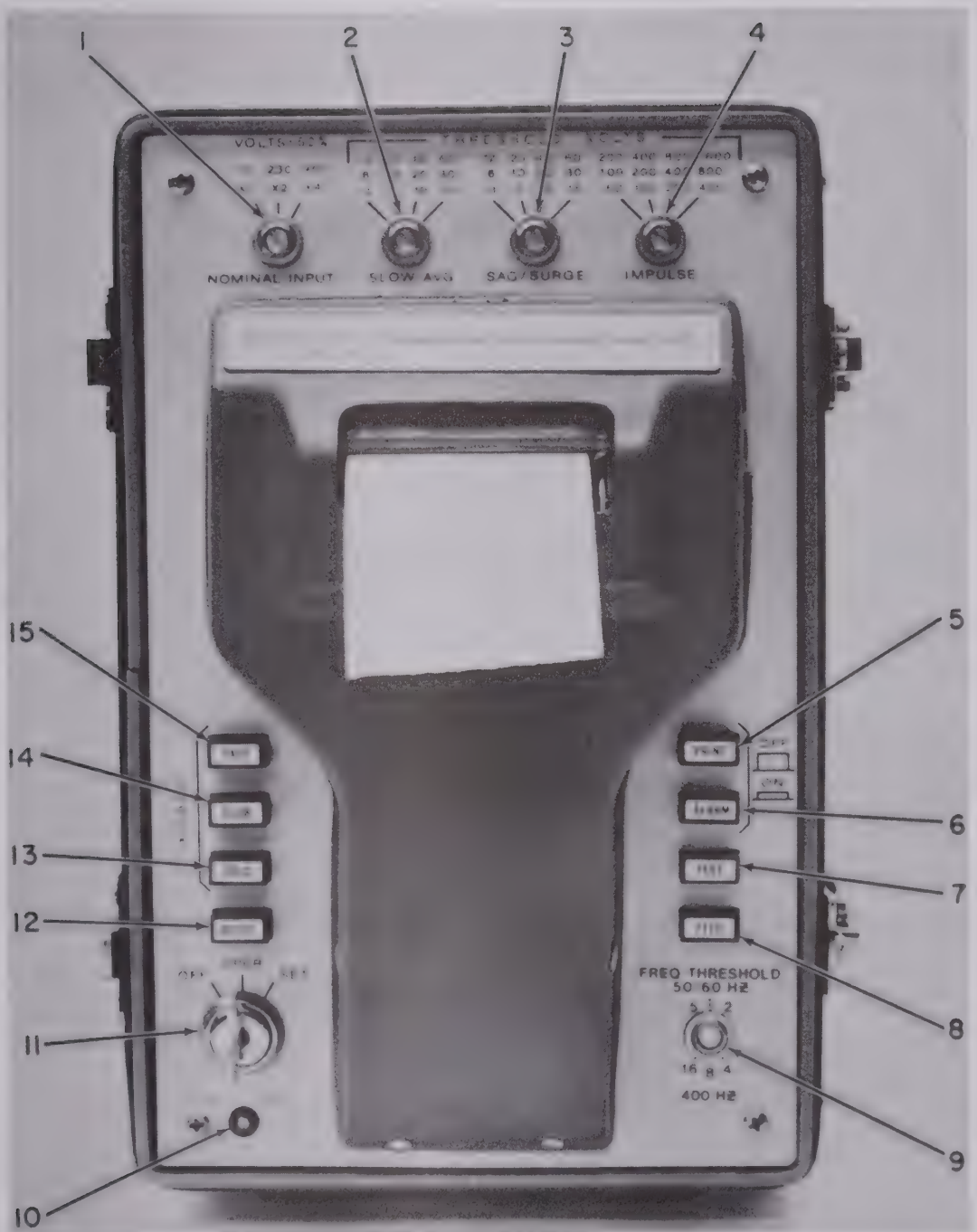


Figure 2-1. Operating Controls and Indicators

TABLE 2-1. OPERATING CONTROLS AND INDICATORS (cont)

Index No.	Controls or Indicators	Function
3	THRESHOLD VOLTS-SAG/ SURGE switch	Selects one of four threshold voltage values for SAG/SURGE disturbances. (Range is color correlated as for SLOW AVG switch.)
4	THRESHOLD VOLTS-IMPULSE switch	Selects one of four threshold voltage values for IMPULSE disturbances. (Range is color correlated as for SLOW AVG switch.)
5	PRINT pushbutton	When depressed to "in" position, normal printout of disturbance data is enabled. When depressed to "out" position, the unit prints out PRINT OFF and time, and further printout is inhibited unless one of the following occurs: 1. TEST button is depressed. 2. Power is turned off or on. 3. End of day produces daily accumulated summary.
6	ALARM pushbutton	When depressed to "in" position, the alarm circuit is enabled.
7	TEST pushbutton	When depressed, unit prints TEST, followed by daily accumulated summary.
8	FEED pushbutton	When depressed, paper tape advances out of printer.
9	FREQ THRESHOLD switch (optional)	Option 101: Selects one of three frequency threshold values (45-65 Hz operation). Option 103: Selects one of three frequency threshold values (45-65 Hz or 380-450 Hz, switch selectable operation.).

TABLE 2-1. OPERATING CONTROLS AND INDICATORS (cont)

Index No.	Controls or Indicators	Function
10	LINE-BATT dual LED indicator	Indicates instrument power source; green for line, red for internal battery (standby mode).
11	Key operated mode switch	OFF position: Instrument is off and key is locked. OPER position: Instrument is on, key may be removed, but CLOCK and RESET buttons are inoperative. SET position: Clock and reset circuits are enabled and key is locked.
12	RESET pushbutton	When depressed (mode switch in SET position), unit prints RESET, day count is reset to 00, accumulated summary is printed and all data is cleared from memory. Instrument clock is not affected.
13	CLOCK HOLD pushbutton	When depressed, freezes instrument time at its last value.
14	CLOCK SLOW pushbutton	When depressed, advances instrument time at slow rate (1 min/sec).
15	CLOCK FAST pushbutton	When depressed, advances instrument time at fast rate (1 hr/sec).

2-4. OPERATIONAL DESCRIPTION

a. Disturbance Measurements

1. Slow Average. The slow average measurement represents a steady state RMS level value based on a 10-second moving average of the monitored voltage. The slow average printout value is always accompanied by time in hours, minutes, and seconds. As an example, the printout

A 100V AVG+
16:29:03

indicates that the channel A slow average measured at 16:29:03 was 100 volts RMS. Assume that the SLO AVG switch is set to 5 volts. When any

subsequent channel A slow average measurement changes from the above printout by 5 volts (drops to 95 volts or rises to 105 volts), the instrument responds by printing out the time, channel, new RMS voltage and a plus or minus sign to indicate the direction of change from the previous printout. For example the next slow average printout may take the following form

A 095V AVG -

18:05:56

NOTE

Since the paper tape moves downward, the time value is printed first, followed by the average voltage value.

Once a new slow average printout occurs, that value becomes the new reference for the SLO AVG switch setting. Thus, for the example given, the next slow average printout occurs when the measured value drops to 90 volts or rises to 100 volts RMS.

2. Sag/Surge - Sags and surges are sudden negative or positive changes in the RMS value of the monitored voltage. The Analyzer measures the RMS value of each AC cycle and compares it with the slow averaged steady state RMS value. If the single cycle measurement is lower, the Analyzer recognizes a SAG; if higher, it recognizes a SURGE. If the RMS change exceeds the threshold setting of the SAG/SURGE switch, the Analyzer prints out time, channel (A, B, or C), RMS value of the most extreme 1-cycle measurement, and the duration in number of cycles. In addition, the RMS reading is identified as a SAG or SURGE. As an example, the printout

0013 CYCLES
B 124V SURGE
13:28:21

indicates that a surge to 124 volts RMS of 13 cycle duration was measured on the channel B input at 13:28:21. Again, it should be noted that SAG and SURGE printouts occur only when the limits set by the SAG/SURGE switch setting are exceeded.

3. Impulse. Transient impulses (spikes) having a duration between 0.5 and 800 microseconds are continuously monitored by the Analyzer. The instrument samples each channel of the input line in 2-cycle periods, holding the highest peak value measured (excluding instantaneous AC line voltage). If one or more impulses measured in any 2 cycle interval exceeds the threshold value selected by the IMPULSE switch,

the Analyzer prints the time, channel designation, highest peak value measured and the word IMPULSE. As an example, the printout

C 0144 V IMPULSE
C 0195 V IMPULSE
17:59:01

indicates that two impulses, one of 195 volts peak and another at 144 volts peak were measured on the channel C input at 17:59:01.

NOTE

All references to measurements and printouts of line disturbances in the balance of this manual presuppose that the instruments threshold settings have been exceeded.

b. Summary modes

1. Stored Disturbances. If line disturbances occur during printout, the Analyzer continues to measure them and stores data on up to 15 sequential disturbances in memory. These are printed out in proper sequence when the printer is free.

2. Short Term Accumulated Count Mode. If the number of disturbances to be stored reaches 16, the internal computer switches to a short term accumulated count mode and stores summarized data. When stable conditions return and after the individual disturbance data stored in memory have been printed out, a short term summary printout of the overflow disturbances is produced for each channel. The following is an example:

C 105V AV 18:03:38
B 102V AV 18:03:35
IMP 0184V 0012 HTS
SAG 070V 0014 HTS
SUR 102V 0003 HTS
LO AVERAGE 085V
HI AVERAGE 100V
A 100V AV 18:03:32
SHORT TERM ACCUM

This printout, identified as a short term accumulated summary, indicates the following:

(a) RMS value of voltage on channel A is 100 volts, measured at 18:03:32.

(b) Highest slow average voltage that occurred during overflow interval was 100 volts RMS.

(c) Lowest slow average voltage that occurred during overflow interval was 85 volts RMS.

(d) Highest SURGE RMS voltage that was measured is 102 volts; total number of SURGE occurrences during overflow interval was 3.

(e) Lowest SAG RMS voltage that was measured is 70 volts; total number of SAG occurrences during overflow interval was 14.

(f) Highest IMPULSE voltage that was measured is 184 volts peak; total number of impulses during overflow interval was 12.

(g) RMS value of voltage on channel B is 102 volts, measured at 18:03:35. (No channel B disturbances occurred during overflow interval).

(h) RMS value of voltage on channel C is 105 volts, measured at 18:03:38. (No channel C disturbances occurred during overflow interval).

3. Daily Accumulated Count Mode. At the start of each day (time 00:00:01), the Analyzer automatically prints out a summary of the previous day's activity. The following is an example:

```
C 105V AV 00:00:07
B 104V AV 00:00:06
IMP 0208V 0004 HTS
SAG 086V 0002 HTS
SUR 124V 0003 HTS
LO AVERAGE 090V
HI AVERAGE 100V
A 100V AV 00:00:01
DAY 22 ACCUM
```

This printout, identified as the accumulated summary of day 22, indicates the following:

(a) Latest measured value of channel A slow average voltage, at time 00:00:01 (of new day 23) is 100 volts RMS.

(b) Highest measured value of channel A slow average voltage in past 24 hours* was 100 volts RMS.

(c) Lowest measured value of channel A slow average voltage in past 24 hours* was 90 volts RMS.

*Or since reset, if instrument was reset in past 24 hours.

(d) Highest measured channel A SURGE voltage in past 24 hours* was 124 volts RMS; a total of three SURGE voltages occurred.

(e) Lowest measured channel A SAG voltage in past 24 hours* was 86 volts RMS; a total of two SAG voltages occurred.

(f) The highest measured channel A IMPULSE voltage in past 24 hours* was 208 volts peak; a total of four IMPULSES occurred.

(g) Latest measured value of channel B slow average voltage, at time 00:00:06 is 104 volt RMS. (No chan. B disturbances occurred.)

(h) Latest measured value of channel C slow average voltage, at time 00:00:07 is 105 volt RMS. (No chan. C disturbances occurred.)

NOTE

At the end of the daily accumulated count, the computer memories are cleared of data (reset) and the day counter is advanced to the next day (day 23 in the above example).

4. Test Mode. When the TEST pushbutton is depressed, the same information printout described in the Daily Accumulated Count Mode is printed out. In this case, the first line of the printout takes the following form

TEST DAY 22 ACCUM

and since the day has not ended, stored disturbance data is not affected and the day counter is unaffected.

The TEST pushbutton also activates a memory validation test. If the data memory is invalid, the TEST printout is immediately followed by:

C 116V AVG +
B 115V AVG +
A 115V AVG +
17:22:48
RESET

This printout clears all stored disturbance data and reestablishes the average values indicated. The occurrence of this printout is extremely rare under normal operating conditions.

5. Reset Mode. When the RESET pushbutton is depressed (with mode switch in SET position) the same information printout described in the Daily Accumulated Count Mode is printed out. The first line of the printout takes the following form:

RESET DAY 22 ACCUM

*Or since reset, if instrument was reset in past 24 hours.

After this printout, the computer memories are cleared of data (reset) and the day counter is also reset (set to DAY 00).

c. Interruptions of Line Power. If the AC or DC line that powers the Analyzer is interrupted, a printout such as the following is produced:

POWER OFF 02:06:43

At this time, the instrument switches to internal batteries which maintain the clock and the data stored in computer memory for up to four hours. No new data is accumulated during power off operation.

Ten seconds after power is restored, a printout such as the following is produced:

POWER ON 02:55:01

NOTE

Actual 'power on' occurred at 02:54:51

2-5. CONNECTING UNITS WITHOUT OPTION 102 TO POWER SOURCE

On early models of the Analyzer, connections to the power source are made on a barrier type terminal strip under a small cover at the rear of the unit. (See figure 2-2.) On later models, and on those models equipped with Option 102, a separate power source connector is provided. (See figure 2-3.) Proceed as follows:

a. Insert key in key switch on front panel and set switch to OFF position.

b. Turn off AC or DC power source that is to be used to power Analyzer.

c. On Analyzers equipped with separate power source connectors, connect the AC power source (90 to 140 volts, 45-450 Hz) or the DC power source (120 to 170 volts) to the white and black leads of the interconnecting line cord. (Polarity is not critical.) For safety, connect the GRN terminal to earth ground.

d. On Analyzers not equipped with a separate power connector, proceed as follows:

1. Loosen the two captive screws that secure the upper rear cover to the case and lift captive cover to expose terminal strip. (See figure 2-2.)

2. If powering the unit from an AC power source (90 to 140 volts, 45-450 Hz), connect the single phase line to the three POWER terminals — two AC leads to the WHT and BLK terminals and ground to the GRN terminal. For operation from a DC power source (120 to 170 volts), connect the DC input to the WHT and BLK terminals. (Polarity is not critical.) For safety, connect the GRN terminal to earth ground.

Figure 2-2. Rear View of Analyzer with Terminal Strip Power Source Connections

Figure 2-3. Rear View of Analyzer with Separate Power Source Connector

2-6. CONNECTING UNITS WITH OPTION 102 TO POWER SOURCE

Option 102 provides the Model 606-3 or Model 606-1 with the capability of operating from a 180-280 volt, 47-65 Hz power line as well as from the standard 90-140 volt, 47-450 Hz and 140 volt DC power lines. The optional equipment includes a stepdown autotransformer, a line voltage selector switch, and a means for tapping the autotransformer for high and low input voltage ranges.

Option 102 has no relation to the input(s) being monitored by the Model 606-1 or Model 606-3. All units have a NOMINAL INPUT range switch on the front panel which must be in an appropriate position for the monitored input(s). This switch must be in the proper position whether or not Option 102 is included in the equipment.

a. Preliminary Steps

   1. Disconnect all power sources from the unit.
   2. Unfasten the two screws and lift the plastic terminal strip cover away from the terminal strip.
   3. Unfasten the four screws and remove the plastic rear cover.

b. Selection of Operating Voltage

   1. For operation from 90-140 volts, 47-450 Hz, or for 140 volts DC, place the line voltage selector switch on PC board A10 in the position labeled "115."
   2. For operation from 180-280 volts, 47-65 Hz, place the line voltage selector switch on PC board A10 in the position labeled "230." Two high voltage taps on the input autotransformer are provided. For operation from 220-280 volts, 47-65 Hz, the red/white jumper wire on PC board A10 should be placed on the terminal labeled "240." For operation from 180-240 volts, 47-65 Hz, the red/white jumper wire should be placed on the terminal labeled "210."
   3. Replace the rear cover. Securely fasten the four screws. (Do not replace terminal strip cover.)

2-7. CONNECTING ANALYZER TO AC POWER LINE(S) TO BE MONITORED

CAUTION

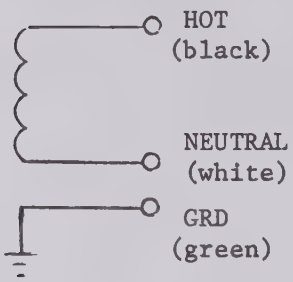
The ground wire should be connected for safety, in the event the normal ground through the power cord is disconnected.

a. Turn off the source of the AC power line(s) to be monitored.

b. The following figures show some typical connections.

Model 606-1 (Single Channel)

3-Wire Wall Receptacle



Nominal Input Switch = 115V

Channel	Mode	Terminal	Wire
A	Normal	A1	Black
		A2	White

Green wire to Frame Ground Terminal

Model 606-3 (Three Channel)

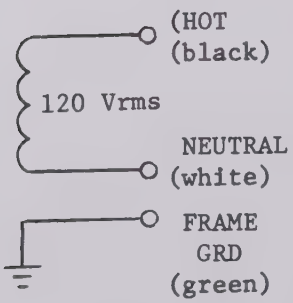
NOTE

When monitoring less than 3 phases, Channel A must be connected to the AC power. This input controls timing and must be provided with the following minimum voltages for proper operation:

for Range = X1, A_{input} = 32 volts min.
for Range = X2, A_{input} = 64 volts min.
for Range = X4, A_{input} = 128 volts min.

In all cases, the green wire should be connected to the frame ground terminal.

3-Wire Wall Receptacle

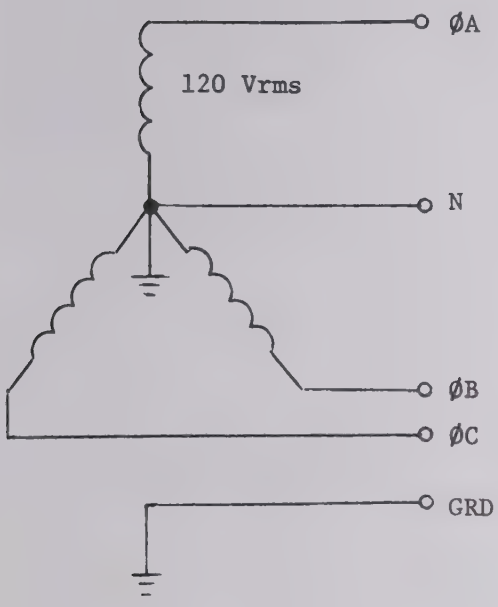


Nominal Input Switch = 115V

Channel	Mode	Terminal	Wire
A	Normal	A1	Black
		A2	White
B	Common	B1	Black
		B2	Green
C	Common	C1	White
		C2	Green

CAUTION: Always verify proper voltages with a voltmeter before applying power to any part of the Model 606-3.

Three-Phase 120/208V WYE with Grounded Neutral



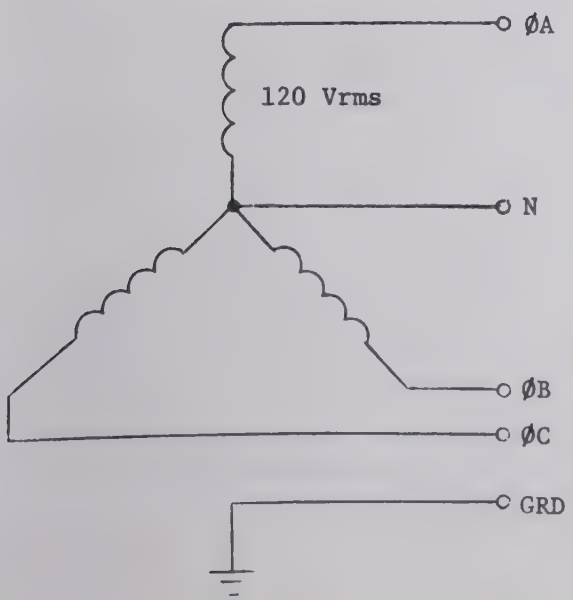
Arrangement I: Nominal Input Switch = 115

Channel	Mode	Terminal	Wire
A	Normal	A1	ØA
		A2	N
B	Normal	B1	ØB
		B2	N
C	Normal	C1	ØC
		C2	N

Arrangement II: Nominal Input Switch = 230

Channel	Mode	Terminal	Wire
A	Normal	A1	ØA
		A2	ØB
B	Normal	B1	ØB
		B2	ØC
C	Normal	C1	ØC
		C2	ØA

Three-Phase 120/208V WYE with Ungrounded Neutral



Arrangement I: Nominal Input Switch = 115

Channel	Mode	Terminal	Wire
A	Normal	A1	ØA
		A2	N
B	Normal	B1	ØB
		B2	N
C	Normal	C1	ØC
		C2	N

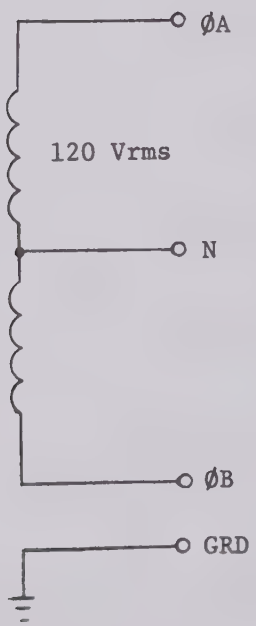
Arrangement II: Nominal Input
Switch = 230

Channel	Mode	Terminal	Wire
A	Normal	A1	ØA
		A2	ØB
B	Normal	B1	ØB
		B2	ØC
C	Normal	C1	ØC
		C2	ØA

Arrangement III: Nominal Input
Switch = 115

Channel	Mode	Terminal	Wire
A	Normal	A1	ØA
		A2	N
B	Normal	B1	ØB
		B2	N
C	Common	C1	N
		C2	Grd

120/240V Single Phase



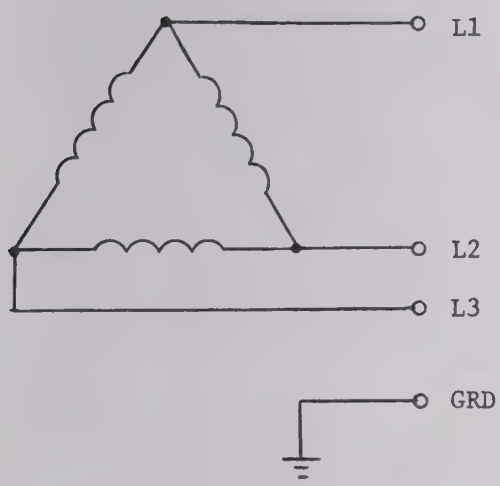
Arrangement I: Nominal Input
Switch = 230

Channel	Mode	Terminal	Wire
A	Normal	A1	ØA
		A2	ØB
B	Normal	B1	ØA
		B2	N
C	Normal	C1	ØB
		C2	N

Arrangement II: Nominal Input
Switch = 115

Channel	Mode	Terminal	Wire
A	Normal	A1	ØA
		A2	N
B	Normal	B1	ØB
		B2	N
C	Common	C1	N
		C2	Grd

Three Phase
240V Ungrounded DELTA



Arrangement I: Nominal Input
Switch = 230

Channel	Mode	Terminal	Wire
A	Normal	A1	L1
		A2	L2
B	Normal	B1	L2
		B2	L3
C	Normal	C1	L3
		C2	L1

Arrangement II: Nominal Input
Switch = 230

Channel	Mode	Terminal	Wire
A	Common	A1	L1
		A2	Grd
B	Common	B1	L2
		B2	Grd
C	Common	C1	L3
		C2	Grd

CAUTION

Always verify proper voltages with a voltmeter before applying power to any part of the Model 606-3.

c. If the Analyzer is to activate an external alarm or control when a disturbance threshold is exceeded, connect the alarm or control to the two ALARM RELAY terminals.

d. If using Option 104, connect leads from circuit to be monitored to rear terminals marked OPT 104 observing polarity. Note that the time mark activating level is 5 to 12 volts DC.

e. When all connections have been completed, replace the top cover over the terminal strip and secure it to the case by tightening the two captive screws.

2-8. OPERATION

To prepare the Analyzer for operation, proceed as follows:

a. Use a screwdriver to set the NOMINAL INPUT switch to 115, 230, or 460, according to the RMS value of the voltage to be monitored. Note that the actual RMS value of the voltage may be within 50% of the nominal value.

b. Set the SLOW AVG, SAG/SURGE, and IMPULSE screwdriver switches to the desired threshold values, selecting the value from the same color correlated range as the NOMINAL INPUT setting.

NOTE

If the disturbance characteristics of the line to be tested are unknown, start with low threshold values. If too many printouts are produced after the Analyzer is turned on, increase the threshold settings until the necessary data is provided in a convenient form.

c. Turn on the power and line voltage source to be monitored.

d. To operate the Analyzer in its normal print mode, depress the PRINT pushbutton to the "IN" position. If restricted printer operation is desired, depress the PRINT pushbutton to the "OUT" position.

e. To activate the 1-second audio alarm depress the ALARM pushbutton to the "IN" position.

f. Check that end of paper tape extends out of the printer opening.

NOTE

Refer to paragraph 2-11 for paper tape installation and adjustment.

g. Rotate the key switch from OFF to SET. The LINE indicator will light. Now set the instrument clock as follows:

1. Advance the clock through 00:00:00 by depressing the FAST pushbutton, then advance the clock slightly past the real or system time to which the unit is to be synchronized. To do this, first depress the FAST or SLOW pushbutton (as appropriate) until the desired time printout is obtained. Now depress HOLD button to stop the instrument time until real or system time coincides with instrument time, then release HOLD button. It should be possible to synchronize instrument time to real or system time to within one second.
2. When the clock is properly set, depress RESET switch to clear out computer memories and to reset day counter to day 00.
3. Reset key switch to OPER position.

NOTE

Although the day counter cycles from day 00 to day 99, the count will return to 00 at the 100th day and normal operation will continue indefinitely.

4. No further procedures are required. Operation of the Analyzer is completely automatic. With the key switch in the OPER position, the key may be withdrawn to prevent inadvertent turnoff, clock alteration, or resetting of the Analyzer.

2-9. OPERATION WITH OPTION 101

When Option 101 is supplied with the Series 606-3 Analyzer, an additional screwdriver switch marked FREQ THRESHOLD is installed at the lower right hand corner of the Analyzer panel. This switch sets the frequency threshold above or below which a frequency printout is produced. For Option 101, only the 50/60 Hz (upper) markings on the switch are applicable. Simply set the switch to the desired threshold value (.5, 1, or 2 Hz). When the frequency of the monitored line voltage (channel A only) deviates by more than the selected threshold value, a printout similar to the following will be produced:

FREQ 060.5HZ
04:09:48

Since the frequency measurement is based upon counting cycles over a 1-second interval, a line voltage interruption of 5 cycles or more could cause a frequency disturbance to be detected and printed by the Analyzer. Therefore, in the case of a power interruption, the recorded frequency could fall as low as 42.7 Hz (341.3 Hz for 400 Hz monitoring).

2-10. OPERATION WITH OPTION 103

Option 103, available only with Option 101, is designed to monitor and to measure the frequency of 400 Hz power lines. It includes the same FREQ THRESHOLD switch as that described for Option 101. In this case both the 50/60 Hz and 400 Hz switch markings are applicable. When using the Analyzer to monitor 400 Hz lines, a choice of 4, 8, or 16 Hz thresholds are available. Selection of either 50/60 Hz or 400 Hz Monitoring is controlled by an internal toggle

switch on PC board A2. The up position is for 400 Hz monitoring; the down position enables 50/60 Hz monitoring. In those units which contain a 3-position switch, the center position should never be used during operation of the Analyzer. When measuring 400 Hz signals, the sag/surge measurements (para. 2-4a2, page 2-5) are made over 8 cycles of the 400 Hz signal.

2-11. INSTALLATION OF PAPER TAPE (See figures 2-5 through 2-7).

The Analyzer is shipped with a roll of paper already installed. During operation, when the paper supply becomes low, the unit will automatically print PAPER LOW (and operation will be shifted to the "PRINT OFF" mode) indicating that the paper roll should be replaced.

NOTE

In the "printer off" mode, normal printout of disturbances data is inhibited and only the daily accumulated summary is produced. Therefore, if it is anticipated that a large number of disturbances will occur during a period of unattended operation, do not wait for a PAPER LOW condition - install a full roll of paper.

Before replacing the thermally sensitive paper, clean the printhead as described in paragraph 2-12. After cleaning the printhead, replace the paper roll as follows:

a. Depress upper edge of paper and printer cover and lower cover as shown in figure 2-5.

b. Tear paper roll just above old roll. Do not remove remaining paper from printer.

c. Push two spring paper holders outward to release old paper roll and remove roll.

d. Remove holding tab from new paper roll to release end of roll. Use a scissors to cut the edge of the paper straight.

e. Holding the paper roll so that it unrolls as shown in figure 2-5, expand the two spring paper holders, install the roll, then release the holders to lock the roll in place.

NOTE

If there is no paper in printer, proceed directly to step i.

f. Ensuring that the new paper is aligned correctly to avoid jamming, insert the cut end between the rubber roller and the remaining old paper so that the old and new paper overlap. (See figure 2-6A.)

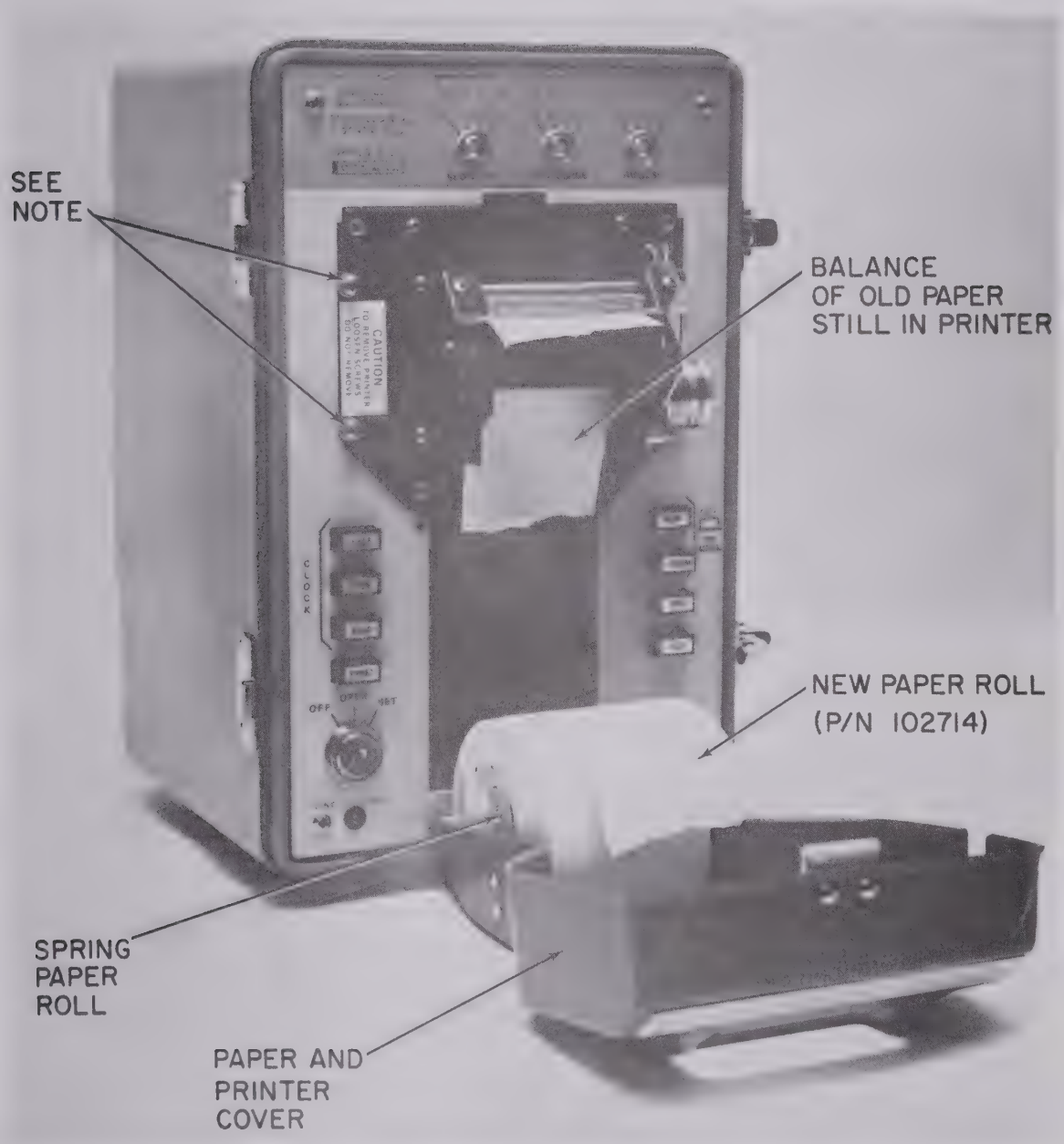


Figure 2-5. New Paper Roll Installed in Cover

g. Depress and hold FEED pushbutton until the new paper comes into view and the old paper is completely out of the printer. (See figure 2-6B.)

h. Raise cover and guide paper through opening as shown in figure 2-1, then lock cover in place.

NOTE

Proceed with the following steps only if there is no paper in printer.

CAUTION

BE SURE THAT HANDS ARE CLEAN. ANY GREASE OR FOREIGH MATTER ON HANDS MAY CONTAMINATE ROLLER AND CAUSE PRINTER TO MALFUNCTION.

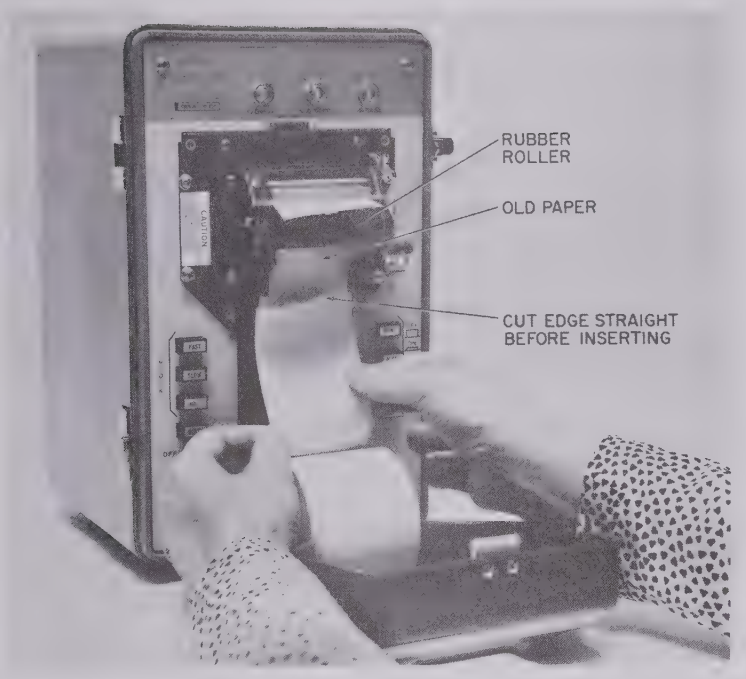
i. Using one hand, feed the cut end of the new paper between the rubber roller and the feed chute opening under the printer as shown in figure 2-7A. Using the thumb on the other hand, gently rotate rubber roller in the forward direction until the paper comes into view. (See figure 2-7B.)

j. Depress and hold FEED pushbutton to ascertain that paper moves smoothly. If not, repeat procedure to step i.

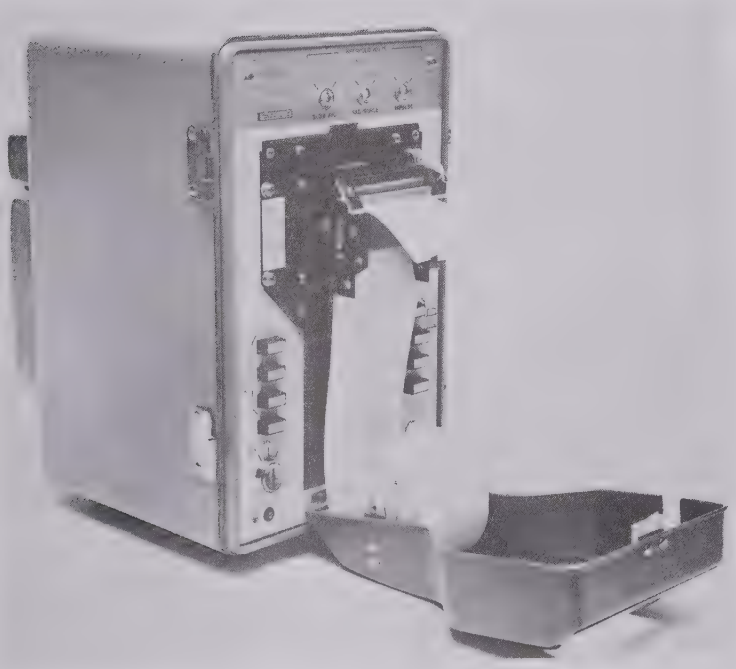
k. Raise cover, guide paper tape through opening, then lock cover in place.

NOTE

Due to the coiling action of the paper on its spool, it is likely that repetitive printouts of the PAPER LOW message will occur until the paper supply is clearly below the triggering point of the optical paper sensors. This occurrence is intentional and should not be a cause for concern.



A



B

Figure 2-6. Inserting New Paper When Some Paper is in Printer

A

B

Figure 2-7. Inserting New Paper when No Paper is in Printer

2-12. CLEANING PRINTHEAD

During the course of normal printer operation, minute particles of thermal sensitive material tend to be dislodged from the surface of the printer paper. These particles accumulate on the surface of the heating matrix in the printhead. This causes a reduction in heat-flow to the paper causing the following symptoms:

Print density too light
No printout
Missing dots

To clean the printhead in the simplest and preferred method, particles may be removed by inserting a length of bond paper (approximately 10 inches in length cut to width of 2.25 inches) into the printer and operating the printer by pressing the TEST button until the length of paper passes through the printer. Insert this paper in the same manner as if replacing the paper roll.

NOTE

For your convenience Dranetz has made available a precut paper roll (Dranetz P/N 103418). This paper serves as an abrasive which buffs the surface of the printhead clean. It is a recommended good practice to clean the printhead each time the thermal sensitive paper roll is replaced.

2-13. OPTION 105 INTERCONNECTIONS (FOR USE WITH 606-PA-600X)

Option 105 for late model* Analyzers has been updated to utilize Interface Cable Assembly 110025-G1 (for Option 105 only) or Cable Assembly 110025-G3 (for both Options 105 and 106). See figure 2-9.

2-14. USE OF OPTION 106 (RS232C INTERFACE ADAPTER)

Option 106 allows the data from late model* Analyzers to be outputted to a remote printer or peripheral device via Interface Cable Assembly 110025-G( ).

NOTES

1. For Option 106 only, use Interface Cable Assembly 110025-G2. (See figure 2-9.)
2. For Option 106 with Option 105, use Interface Cable Assembly 110025-G3. (See figure 2-9.)

*Applies to Analyzers whose last three digits in the Serial Number is 071 or higher.

a. Option 106 Modes of Operation

1. Mode 1 - Local Printer On. This mode provides for normal Analyzer operation with remote duplication. If the CLEAR TO SEND "CTS" control line is true, data is transmitted. If the CTS line becomes false for more than 300 milliseconds, the RS232C output is disabled, allowing the local printer to resume. This allows for a limited end-of-line type of delay.

2. Mode 2 - Local Printer Off. At the time that the PRINT switch is put into the OFF position, a validity test is made of the CTS line. If CTS is false, then normal Analyzer operation is performed, where printout conforms to the reduced printout of daily and test summaries.

If CTS is true when the PRINT switch is put in the OFF position, then a swapping mode is initiated, where full fault data is transmitted to the remote. If CTS now becomes false, the local printer is swapped back on to prevent loss of data, and reverts back to remote if CTS becomes true.

This provides for automatic backup should the remote printer run out of paper. To disable this feature, tie the CTS line to logic 1 at the connector.

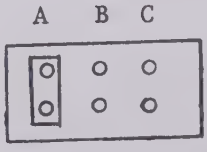
3. Mode 3 - Remote Only Operation. This mode is intended for use where external control of output is required. Mode 3 is enabled by an internal jumper on the A3 board and with the PRINT switch in the OFF position.

Data is transmitted while CTS is true; while CTS is false, data transmission is held back indefinitely.

NOTE

The TIME printout will always be the time of transmission; the daily summary will not be reset until actual transmission of the daily summary is completed. Should the internal fault stack be filled, the short term summary will be enabled as with normal Analyzer operation.

To enable Mode 3, move jumper on A3-J5 from position A to position B. Option 106 is factory supplied for Modes 1 and 2. See figure 2-8 below.



J5 on A3 CPU Board 107415

For RS232C - Mode 1 or Mode 2
Jumper in position A - No jumper in position B - Position C: N/A

For RS232C - Mode 3
No jumper in position A - Jumper in position B - Position C: N/A

Figure 2-8. Mode Selection via Jumper Block J5 on A3

b. Transmission Rates

A switch mounted in the Interface Cable Assembly (figure 2-9) provides for transmission or baud rate selection. Table 2-2 identifies the baud rate associated with each switch position.

NOTES

1. Because of timing internal to the Analyzer, actual data thruput is limited to 360 characters/second maximum.
2. A hole in the 50-pin male connector P1 of the Interface Cable Assembly provides access to the 16-position switch. Use the alignment tool supplied (JFD Adjustment Tool 5284) to select the desired baud rate. The arrow adjacent to the switch slot points to the switch position marked on the external decal. (Ignore internal switch markings.)

Table 2-2. Baud Rate Selection Chart

Position	Baud Rate
1*	50 Not Recommended
2*	75 Not Recommended
3	110
4	134.5
5	150
6	300
7	600
8	1200
9	1800
10	2000
11	2400
12	3600
13	4800
14	7200
15	9600
16*	19200 Not Recommended

*Positions 1, 2 and 16 are not compatible with Analyzer timing and should not be used.

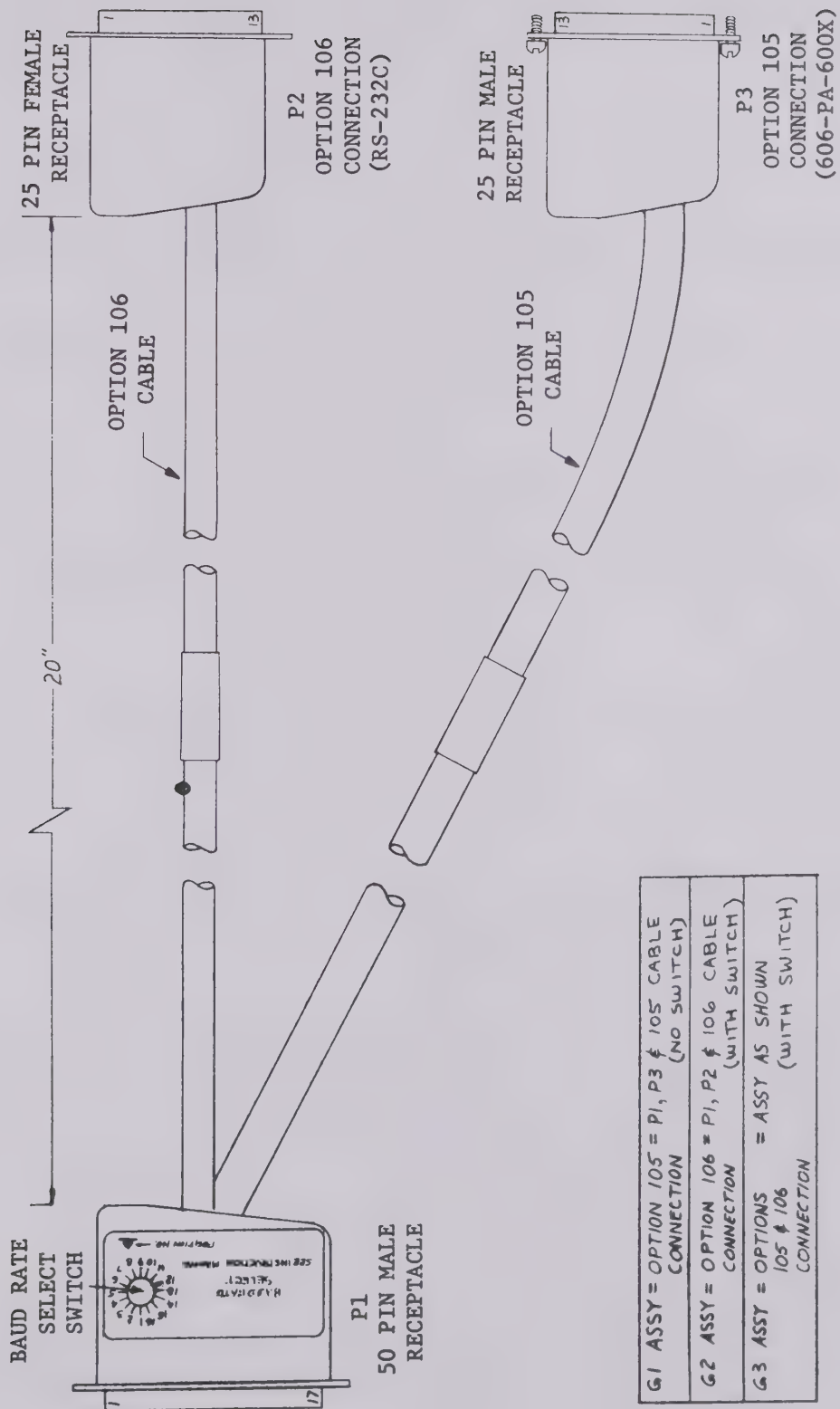

25 PIN FEMALE RECEPTACLE
P2
OPTION 106 CONNECTION (RS-232C)
OPTION 106 CABLE
20"
25 PIN MALE RECEPTACLE
P3
OPTION 105 CONNECTION (606-PA-600X)
OPTION 105 CABLE
BAUD RATE SELECT SWITCH
P1
50 PIN MALE RECEPTACLE
G1 ASSY = OPTION 105 = P1, P3 & 105 CABLE CONNECTION (NO SWITCH)
G2 ASSY = OPTION 106 = P1, P2 & 106 CABLE CONNECTION (WITH SWITCH)
G3 ASSY = OPTIONS 105 & 106 CONNECTION = ASSY AS SHOWN (WITH SWITCH)

Figure 2-9. Interface Cable Assembly 110025-G( )

c. Data Format

Data is a duplicate of that printed on the local Analyzer printer and is sent in ASCII code format as follows:

1 Start Bit
7 Data Bits
1 Bit, Zero Parity
2 Stop Bits

Voltage and impedance levels conform to RS232C standard. The following control lines are used:

CA-RTS - Request to Send, always true
CB-CTS - Clear to Send, used to enable or disable transmissions as described in subpara. a above.

d. Interface Cable Pinouts
(Equivalent to TTY pinouts, for Modem connection.)

Pin	Function
1	Protective Ground (chassis)
2	Data to Remote
3	Data from Remote
4	Request to Send (output always true)
5	Clear to Send, Input for Control
6	Data Set Ready, Input (not used)
7	Signal Ground
20	Not Used

For simplest connection, connect pin 4 to pins 5 and 6 and connect printer input to pin 2. Pin 7 is signal ground; pin 1 is frame ground.

2-15. TEST SUMMARY PRINTOUT

A test summary printout can be initiated from the remote by sending a Control T (DC4) character to the Analyzer. To enable this feature, pin 6 must be a logic true level. Connect pin 6 to pin 4 if not provided by the remote.

Control T is the only character recognized by the Analyzer. All others are ignored.

2-16. INSTALLATION OF MR-15 RACK MOUNT (See figure 2-10.)

Perform the following procedure to remove the main unit of the Analyzer from its case and to attach it to the MR-15 rack panel.

General Precautions

1. Do not attempt to remove the unit from its case without first disconnecting all power sources to the unit.
2. Use CAUTION when handling unit out of its case.
3. Disconnect all external power sources when removing or inserting any cards or integrated circuits.

a. Disassembly

NOTE

Retain all hardware which will be used in reassembly.

1. If the Analyzer is connected to any field wires, first remove the source of power to these wires, then remove them from the Analyzer.

CAUTION

Take required safety precautions with these wires to prevent any shock hazards.

2. Remove case cover - (with inside of open cover facing you, slide cover to right off hinge pins.)
3. Remove the four screws, each located near one of the rubber feet at the rear of the Analyzer.
4. Remove circuit board cover from case by removing four (4) screws and terminal strip cover by removing two (2) screws.

WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

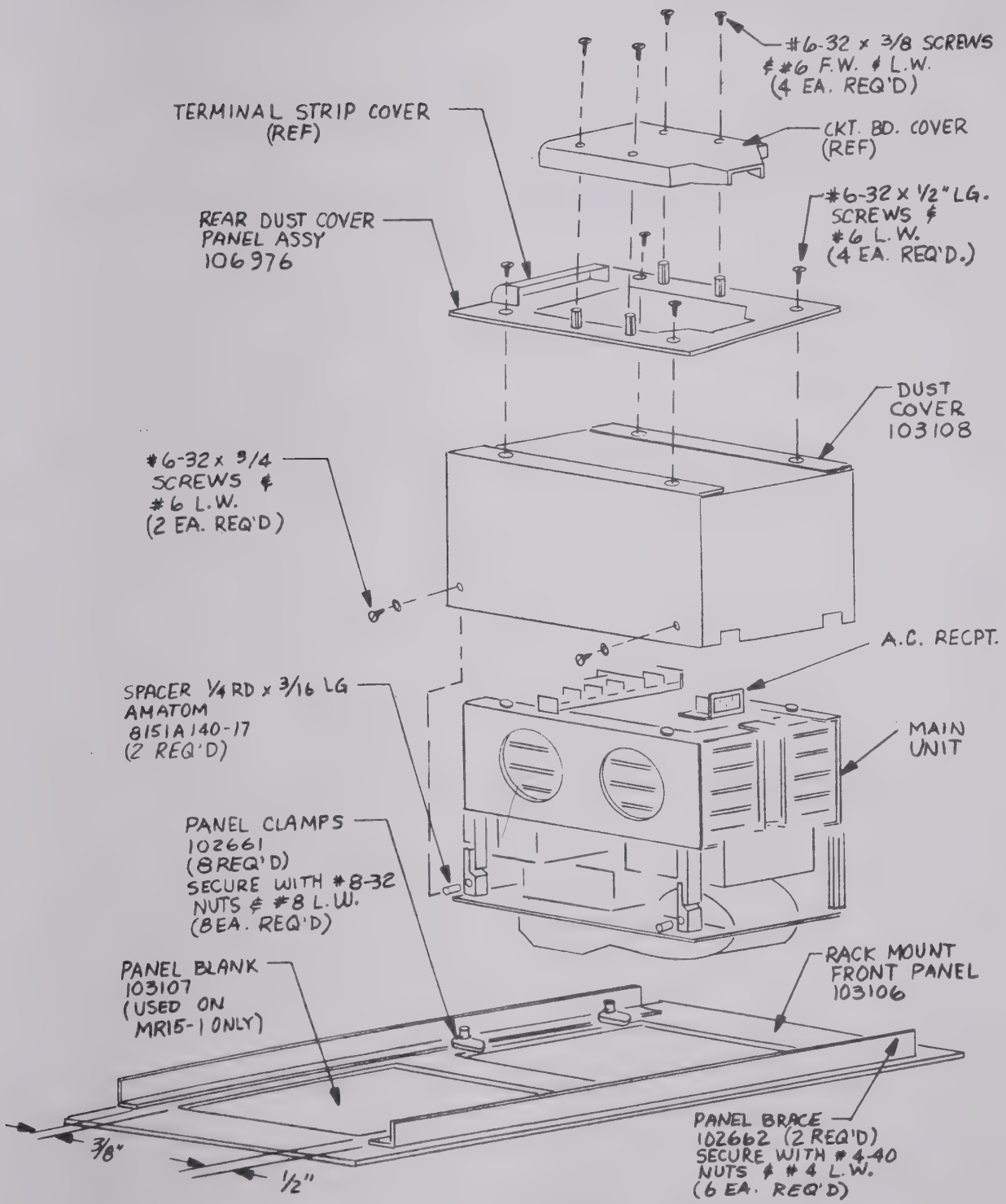


Figure 2-10. MR-15 Rack Mount Installation

5. Set the Analyzer in the normal upright position and remove the two screws on the right hand side of the unit.
6. Open the paper cover, and with one hand, grasp the Printer Assembly. Push the rear terminal strip to remove the Analyzer from its case.
7. When the front panel is clear of the case edge, grasp the unit by the front panel and pull it completely out of the case.

NOTE

On some units, binding may occur when the front panel is about one inch out. An alternate side-to-side motion may be required to allow the internal screw heads to clear a lip on the inside surface of the case.

CAUTION

1. Use care while handling the Analyzer out of its case. It is preferred that several wooden blocks or some suitable insulating material be used to support the unit on its rear. Position the blocks so they do not damage the components which extend from the rear circuit card.
2. Note that exposed parts on rear circuit board are primarily power supply components. Use caution when operating so as not to contact exposed "live" parts.

b. Reassembly (See figure 2-10.)

1. Reassemble main unit to rack panel by first placing rack panel face down on a clean, soft surface.
2. Position panel as in figure, noting 1/2" and 3/8" dimensions.
3. Place panel braces (102662) on panel as shown.
4. Place main unit face down in panel cutout with AC receptacle towards you.
5. Assemble #4-40 nuts & lock washers (supplied) to six (6) 4-40 studs on panel. Hand tighten at this time.

WARNING

Because of possible shock or fire hazards, connection to this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

6. Install four (4) panel clamps (102661) as indicated and attach with 8-32 nuts & lock washers supplied. Tighten nuts hand tight only at this time.
7. Turn front panel and main unit over and align panels so that all panel markings are visible and centered.
8. Tighten clamp nuts and panel brace mounting nuts but do not exceed 2 ft-lbs torque.
9. Assemble dust cover using two (2) inside spacers (8151A140-17) and two (2) 3/4" #6 screws.
10. Assembly rear dust cover panel assy to main unit using four (4) 1/2" #6 screws.
11. Assemble original circuit board cover to rear panel using four (4) original 3/8" #6 screws, and secure terminal strip cover using two (2) attached screws.
12. For MR15-1 Panel Kits install the blank cover in the remaining cut-out using the four (4) remaining panel clamps, #8-32 nuts and lockwashers. Adjust the panel to completely cover the cut-out and tighten the hardware. Do not exceed 2 ft-lbs of torque.
13. For MR15-3 panels, repeat the mounting procedure used for the first unit to mount the second unit.

Parts Supplied

P/N	MR15-1 Qty.	MR15-3 Qty.	Description
106976	1	2	Back panel with standoffs and terminal strip cover assembled.
103106	1	1	Rack mount panel.
102661	8	8	Panel clamps.
103107	1	0	Blank panel.
8151A140-17	2	4	Spacers
102662	2	2	Panel braces.
--	8	8	8-32 Nuts.
--	8	8	#8 Internal tooth lock washers.
--	6	6	4-40 Nuts.
--	6	6	#4 Internal tooth lock washer.
103108	1	2	Dust Cover

WARNING

Because of possible shock or fire hazards, connection to this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

SECTION III

PERFORMANCE TESTS

3-1. SCOPE

This section contains instructions for testing and verifying proper operation of the Analyzer. The procedure includes tests of basic performance characteristics. If any malfunction is detected when performing this procedure, whether specifically tested for or not, it should be corrected.

3-2. TEST EQUIPMENT REQUIRED

Table 3-1 lists the test equipment required for performance testing. Minimum equipment specifications are included in this table to assist in determining suitable items of substitution. It is recommended, however, that prior to substituting any test equipment, adequate equipment performance is verified.

TABLE 3-1. TEST EQUIPMENT REQUIRED

Item	Characteristics	Model
Line Disturbance Simulator	Input: 200-240 VAC, 50/60 Hz or 100-120 VAC, 50/60 HZ Output (% of Input) Avg* 90-110% Sag* 0-10% 20 Cycle max Surge* 0-11% Impulse* 0-400 Volts 5 μsec typ. *Typical into 100K Ω, 680 pf load	Dranetz Engineering Series 604A
Oscilloscope	Bandwidth DC:0 HZ - 10 MHZ AC:2 HZ - 10 MHZ Accuracy 3% Rise time 35 NS	Phillips PM 3234
Voltmeter	AC 30 - 1 MHZ Accuracy - 1%	Ballantine 303-51
Ohmmeter		Simpson 260

3-3. SPECIFICATION TEST SUMMARY

Table 3-2 summarizes the methods used to test the Analyzer characteristics. Use this table in conjunction with the procedures presented in paragraphs 3-4 and 3-5 to test the Model 606-1 or 606-3. Paragraphs 3-6 and 3-7 apply only to the Model 606-3.

As a further aid to evaluating the test procedure results, a typical printout is included at the end of this section. For further clarification, the printout is correlated to the specific paragraphs of the test procedure.

TABLE 3-2. SPECIFICATION TEST SUMMARY

Analyzer Characteristic	Specifications	Test Method
LINE-BATT power indicator	Green-External (LINE) source Red - Internal battery (BATT)	Visual, with key switch in OPER position.
Power On	Print Message XX:XX:XX RESET POWER ON XX:XX:XX	Verified by printout power applied (after 10 seconds)
Reset Mode with respect to OPER and SET positions	OPER position - no print SET position - "reset" printout; all accumulated data reinitialized	Press and release RESET switch with key switch in OPER and SET positions. Verified by printout.
Slow Average Measurements	Range Incr. Value X1 3 5 10 15 X2 6 10 20 30 X4 12 20 40 60	Tested by applying input signal to a selected phase and changing that value by ± the selected threshold value. Verified by printout and repeated for each additional phase.

TABLE 3-2. SPECIFICATION TEST SUMMARY (cont)

Analyzer Characteristic	Specifications	Test Method
Sag/Surge Measurements	Range Incr. Value X1 3 5 10 15 X2 6 10 20 30 X4 12 20 40 60	Tested by applying input signal to a selected phase and changing that value by ± the threshold value, for a limited number of cycles. Repeated for each additional phase.
Impulse Measurements	Range Incr. Value X1 50 100 200 400 X2 100 200 400 800 X4 200 400 800 1600	Tested by applying (to a selected phase) a half sine wave of approx. 5 usec width and amplitude in excess of increment value. Verified by printout and repeated independently for each additional phase.
Test Mode	Summary printout (worst case and number) of all previous disturbances. Typical printout format: IMP 200V 0012 HTS SAG 112V 0002 HTS SUR 128V 0003 HTS LO AVERAGE 114V HI AVERAGE 126V A 120V 09:23:45 TEST DAY 00 ACCUM	Depress and release the TEST switch. Verify printout by comparison to all previous disturbances. NOTE Test printout followed by a reset printout (without having pressed RESET switch) indicates internal memory is defective.
Reset Mode	Summary printout similar to test printout. All previous disturbances and day counter are cleared from all summary mode functions.	With key switch in SET position, depress and release the RESET switch. Verify printout by comparison to all previous disturbances. Depress and release TEST switch and verify that all accumulated disturbances and day counter are reinitialized.

TABLE 3-2. SPECIFICATION TEST SUMMARY (cont)

Analyzer Characteristic	Specifications	Test Method
Short Term Accumulated Mode	Summary printout of disturbances that occur on the monitored signal (similar to test printout) which are not printed individually.	
	CASE I. PRINT switch is in the off position when disturbances occur and is then set to the on position.	Tested by setting the PRINT switch to the off position and generating several disturbances. Printout verifies disturbances when PRINT switch is set to the on position.
	CASE II. More than 15 disturbances occur prior to being printed.	Tested by generating disturbances at a rapid rate. Verified by printout.
	CASE III. Paper low mode. When the paper supply becomes low, a warning message is printed at various times. When the paper becomes too low, a reduction of printout occurs. When the Analyzer enters this mode, all disturbances are entered into a short term accumulated mode and are not individually printed. No other functions are affected.	Tested by opening the protective cover, generating disturbances, and then closing the cover. Verification is accomplished by comparison of printout and the disturbances entered.

TABLE 3-2. SPECIFICATION TEST SUMMARY (cont)

Analyzer Characteristic	Specifications	Test Method
Clock Hold	Prevents the time from being advanced. Printout of time continues as long as the CLOCK HOLD switch is depressed. Function is disabled when key switch is in OPER position.	Tested by pressing CLOCK HOLD switch (key switch in the SET position). Verified by printout. Also tested by depressing CLOCK HOLD switch with key switch in the OPER position. Verified by no printout and no effect on time.
Clock Slow	Advances time at approximately 1 min/sec. rate. Printout of time continues as long as the CLOCK SLOW switch is depressed. Function is disabled when key switch is in OPER position.	Tested in similar manner as hold function. Verified by printout.
Clock Fast	Advances time at approximately 1 hr./sec. rate. Printout continues for the duration that the CLOCK FAST switch is depressed. Function is disabled when key switch is in OPER position.	Tested in similar manner as hold function. Verified by printout.
Daily Accumulated Mode	Summary of previous disturbances. Occurs at the end of each 24 hr period. Printout format is similar to reset. All accumulated disturbances are reinitialized and day counter is advanced.	Time clock is advanced with CLOCK SLOW and CLOCK FAST switches in excess of 23:59:59. Printout automatically follows. Verified by comparison with all previous disturbances. TEST switch is depressed and released to verify that day counter is advanced and accumulated disturbances are cleared.

TABLE 3-2. SPECIFICATION TEST SUMMARY (cont)

Analyzer Characteristic	Specifications	Test Method
Power Off Mode	A power off message and time are printed when the input power source is removed (or when the key switch is turned from the OPER to OFF position). Internal batteries maintain all accumulated data such that when power is restored no data is lost (except if unit is turned off).	Tested by entering data (disturbances) into the Analyzer and disconnecting the power source. Verified by printout and power indicator (red = battery operation). Restoration of power and the test function verify no data loss.
Audio Alarm	When a disturbance occurs, the alarm will be triggered for approximately 1 second. The alarm is enabled or disabled by front panel ALARM switch.	Tested by generating a disturbance and verifying operation.
External Alarm	Relay contacts are provided on the rear terminal strip. When a disturbance occurs the relay contacts close for approximately 1 sec. (NOTE: Operation is independent of front panel ALARM switch.)	Tested by connecting an ohmmeter across the alarm terminals, generating a disturbance and verifying relay closure.

3-4. PRELIMINARY PROCEDURE

a. Verify that all power switches are in the off positions, then connect the Analyzer and the disturbance simulator to the appropriate power source.

b. Set the NOMINAL INPUT switch to the X1, 115 position.

c. Set all THRESHOLD VOLTS switches to their maximum positions:

SLOW AVG	15V
SAG/SURGE	15V
IMPULSE	400V

d. Set the PRINT switch to its On position.

e. Set the ALARM switch to its Off position.

f. Verify that an adequate paper supply exists and is installed properly (as per Instruction Manual).

g. Connect the cable assembly of the Model 604A to the Model 606 as shown in figure 3-2 (for later 606 models) or as shown in figure 3-1 for earlier 606 models.

CAUTION

Be sure to connect cable assembly to the Model 606 before connecting P1 to the Model 604A.

h. Set the PHASE switch on the Model 604A to the A position. For this test setup, the AC sources for the Model 606 are as follows:

Phase A	Line Disturbance Simulator Output
Phase B and C	115V RMS (nominal)

i. Connect the voltmeter and oscilloscope to the output of the line disturbance simulator (See Fig. 3-1.)

j. Connect the ohmmeter to the relay connections provided on the rear terminal strip.

k. Set the NORM/IMP CAL Switch of the line disturbance simulator to the NORM position.

l. Set the ON-OFF switch on the Model 604A to the ON position.

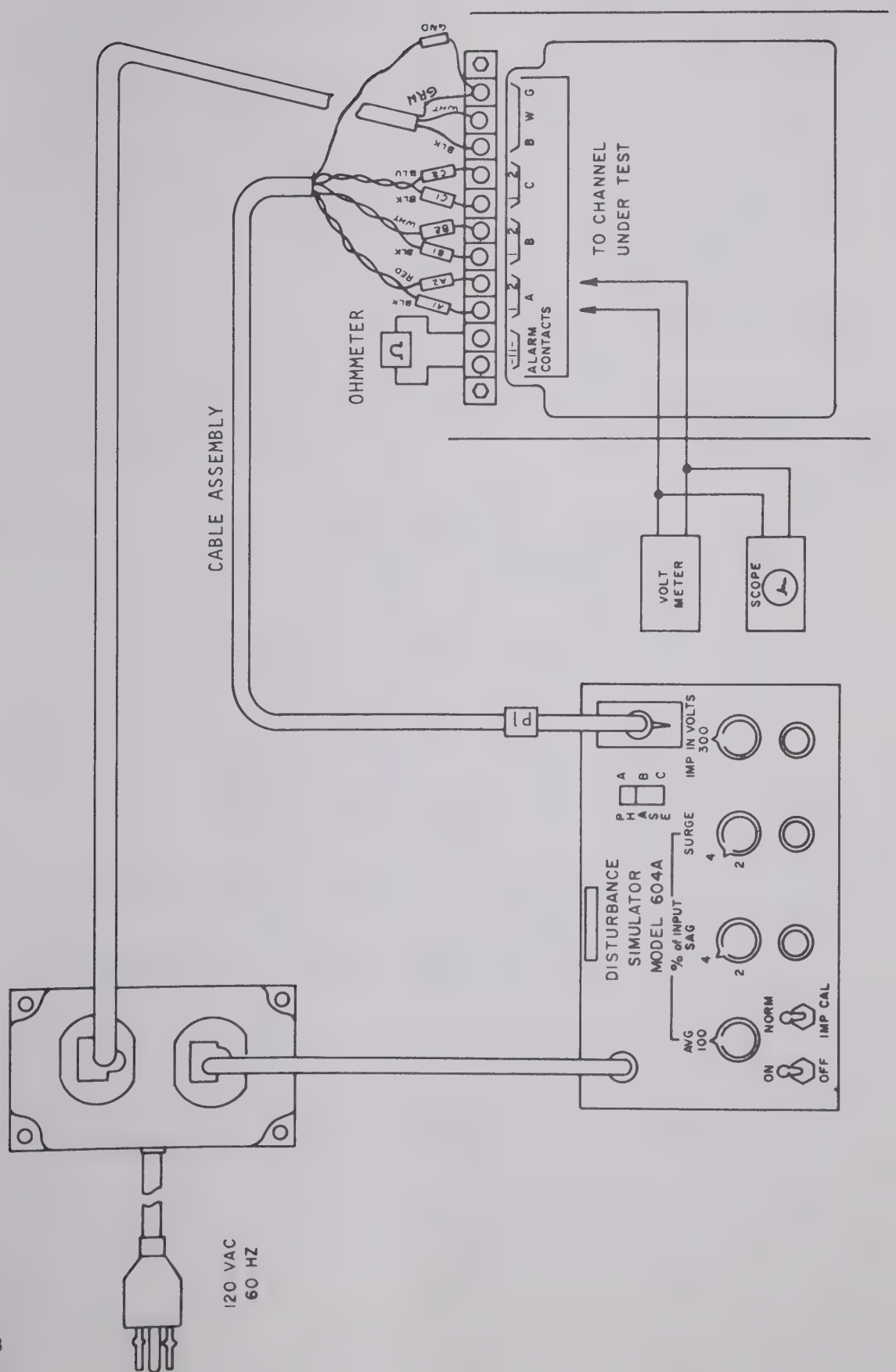


Figure 3-1. Typical Test Set-Up (Phase A, B, or C) for Analyzer Using Model 604A (Older 606 Models)

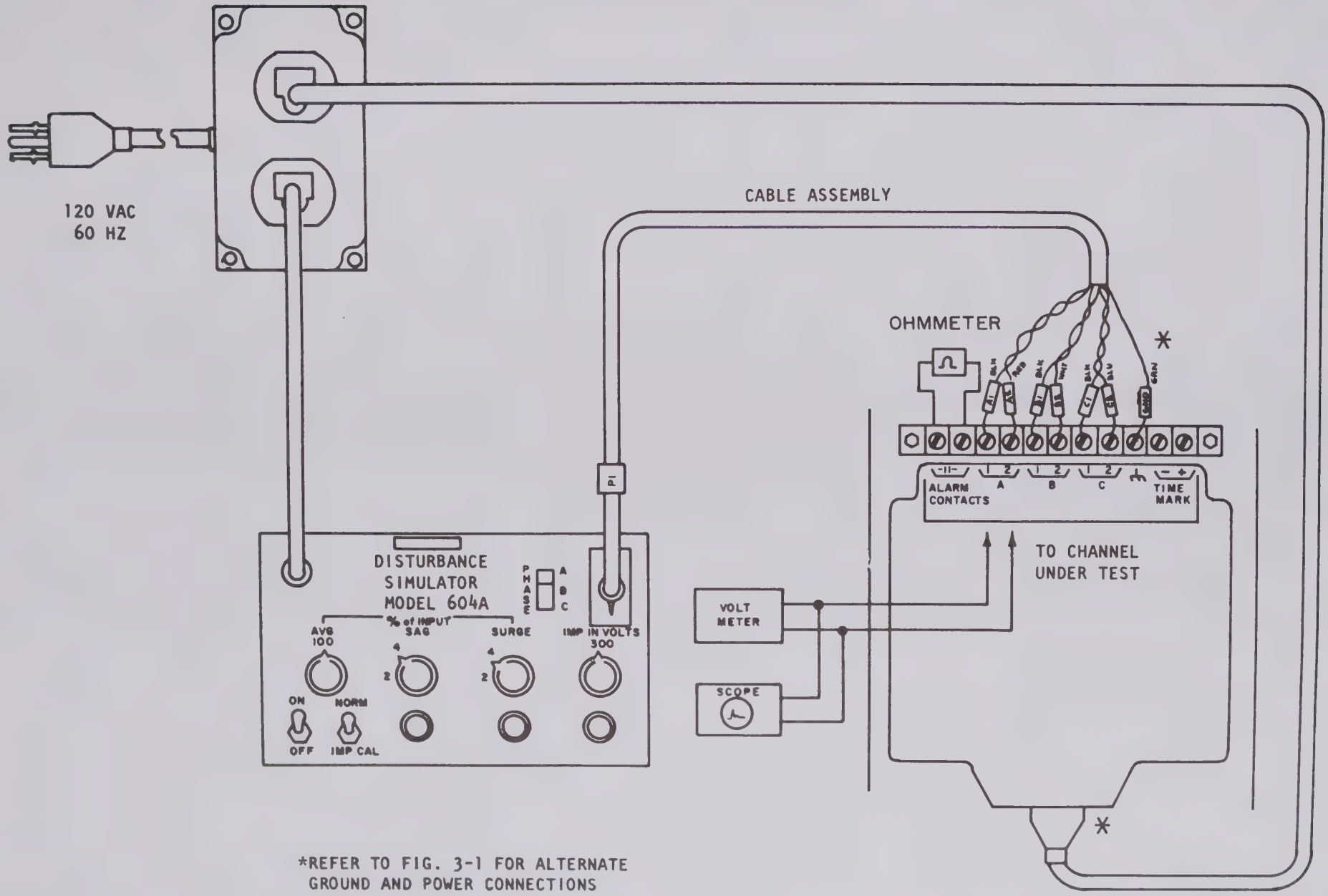


Figure 3-2. Typical Test Set-Up (Phase A, B, or C) for Analyzer Using Model 604A

3-5. TEST AND FUNCTIONAL OPERATION PROCEDURE

NOTE

Any action of the printer that is initiated by a specific step should be completed before proceeding.

a. Power Indicator and Power On Mode

1. Set the key switch to the OPER position and verify that LINE (green) indicator lights.

2. Wait 10 seconds and verify that a power on message is printed.

b. Slow Average Measurements

1. Set the key switch to the SET position.

2. Depress and release the RESET switch.

3. Verify average input measurement by comparing the value printed in para. b above (for the phase connected to the line disturbance simulator) with the voltmeter reading.

4. Set the SLOW AVG threshold switch to the 3 (5,10) volt position.

5. Adjust the input signal for a 3 (5,10) volt difference from the present setting and verify that a corresponding printout occurred.

6. Repeat for values plus and minus over a range of inputs.

Slow Average Accuracy (606);
$\pm$1% of reading, $\pm$1% of nominal input @ 60 HZ.

c. Sag/Surge Measurements

1. Set the SAG/SURGE threshold switch to the 3 (5,10) volt position.

2. Set the desired percentage sag value (Refer to Table 3-3), initiate the setting, and verify that a corresponding printout occurred. Repeat for each value shown.

Sag/Surge Accuracy (606);
±1% of Reading, ±1% of Nominal Input @ 60 HZ

Table 3-3. Approximate 604A Sag/Surge Setting Per Input

Sag/Surge Value	604A Input VAC 50/60 HZ				
	100V	110V	115V	120V	125V
3	3	3	3	3	3
5	5	5	5	5	4
10	10	9	9	9	8

3. Set the SAG/SURGE threshold switch to the 15 volt position.

d. Impulse Measurements

1. Set the SLOW AVG threshold switch to the 10V (or the 15V) position.

2. Set the NORM/IMP CAL switch of the disturbance simulator, to the IMP CAL position. (This step may be omitted. However, the IMP CAL position expedites the following procedures.) Ignore the series of printouts which will occur.

3. Set the IMPULSE threshold switch to the 50 volt position.

4. Set the desired impulse magnitude and initiate the setting on the disturbance simulator. Verify that the printout corresponds with the magnitude measured with the oscilloscope. Repeat for several different values.

   Impulse Accuracy:
   ±5% of Reading ± 1% of Maximum Value.

5. Set the IMPULSE threshold switch to the 400 volt position.

6. Set the NORM/IMP CAL switch of the line disturbance simulator to the ON position.

7. Set the SLOW AVG, SAG and SURGE threshold switches to their 3 volt positions.

e. Test Mode

1. Depress and release the TEST switch.

2. Verify the printout by a comparison with the previous disturbances.

f. Clock Functions

1. Set key switch to OPER position, then depress and release CLOCK HOLD, SLOW and FAST switches. Verify that no printout has occurred.

2. Set the key switch to the SET position.

3. Depress the CLOCK HOLD switch for approximately 10 seconds. Verify that printout occurred while the switch was depressed and that the time did not advance.

4. Depress the CLOCK SLOW switch for approximately 10 seconds. Verify that a printout occurred while the switch was depressed, and that the time advanced approximately ten minutes.

5. Depress the CLOCK FAST switch for approximately 5 seconds. Verify that a printout occurred while the switch was depressed, and that the time advanced approximately five hours.

g. Daily Accumulated Mode

1. Advance the time (FAST, SLOW) such that it is advanced through 00:00:00. Verify that a daily accumulated count printout automatically followed.

2. Verify the printout by comparison to the test printout of subpara. e above.

3. Depress and release the TEST switch. Verify that the day counter is advanced and that all previous disturbances are cleared.

4. Set the key switch to the OPER position.

h. Short Term Accumulation Mode

1. Set the PRINT switch to the Off position.

2. Initiate at least one line disturbance. Verify that no printout occurred.

3. Set the PRINT switch to the ON position. Verify that a short term accumulated printout occurs. Compare printout with disturbance generated in para. h2 above.

4. Generate a series of disturbances (approx. 30) in rapid succession. Verify that printout format changed from individual disturbances to the short term accumulated format. Printout is verified by comparison of disturbances and the total of the individually printed and short term accumulated disturbances.

i. Paper Low Mode

1. Open the plastic cover on the front panel to expose the printer and paper supply. Verify that a paper low printout occurred.

2. Generate several disturbances. Verify that no printout occurred.

3. Close the plastic cover. Verify that a short term accumulated printout occurred.

j. Reset Function Mode

1. Depress and release the TEST switch. Verify that test printout occurs.

2. Set key switch to OPER position, then depress and release the RESET switch. Verify that no printout occurred.

3. Set the key switch to the SET position.

4. Depress and release the RESET switch. Verify printout by comparing it with test printout of subpar. j1.

5. Depress and release the TEST switch. Verify that all accumulated disturbances have been cleared and that day counter has been reset to 00.

k. Audio Alarm

1. Set ALARM switch to the On position.

2. Generate a line disturbance. Verify alarm operation (1 second audio).

l. External Relay. Generate a line disturbance and verify relay closure with ohmmeter.

m. Power Off Mode

1. Depress and release the TEST switch.

2. Disconnect power from the Analyzer without setting the key switch to the OFF position.

3. Verify that a power-off printout occurred and that the red BATT indicator lights.

4. Reconnect power to the Analyzer.

5. Wait approximately 10 seconds.

6. Verify that a power-on printout occurred and that the green LINE indicator lights. NOTE THAT NO RESET IS PRINTED.

7. Depress and release the TEST switch. Verify that printout compares with test printout of subpar. m1. (NOTE: Depending on power source, additional impulse disturbances may occur.)

8. Set the key switch to the OFF position without removing power from the input terminals. Verify that a power-off printout occurred and that the power indicator goes out immediately following the printout.

3-6. PHASE B MONITORING

a. Set the PHASE switch on the Model 604A to the B position. The AC sources for the Model 606 are now configured as follows:

Phase B	Line Disturbance Simulator Output
Phases A and C	115V RMS (nominal)

b. Set the key operated mode switch to the OPER position.

c. Wait approximately 10 seconds.

d. Verify line operation; i.e., green LINE indicator lights and a power-on message is printed.

e. Repeat the procedures of subpar. 3-5b, 3-5c, and 3-5d.

3-7. PHASE C MONITORING

a. Set the key switch to the OFF position.

b. Set the PHASE switch on the Model 604A to the C position. The AC sources for the Model 606 are now as follows:

Phase C	Line Disturbance Simulator Output
Phases A and B	115V RMS (nominal)

c. Set the key operated mode switch to the OPER position.

d. Wait approximately 10 seconds.

e. Verify line operation; i.e., green LINE indicator lights and a power-on message is printed.

f. Repeat the procedures of subpar. 3-5b, 3-5c, and 3-5d.

TYPICAL PRINT-OUT RESULTS OF PHASE A MONITORING

A 122V AVE -
08:10:57

A 125V AVG -
08:10;54

A 128V AVG -
08:10:51

A 131V AVG -
08:10:47

A 134V AVG +
08:10:41

A 131V AVG +
08:10:39

A 128V AVG +
08:10:36

A 125V AVG +
08:10:32

A 122V AVG +
08:10:26 3-5b5

C 120V AVG +
A 119V AVG +
B 120V AVG +
08:09:46

RESET

HI AVERAGE 120V
C 119V AV 08:09:43
HI AVERAGE 120V
B 120V AV 08:09:41
HI AVERAGE 120V
A 119V AV 08:09:38
RESET DAY 00 ACCUM 3-5b2

C 119V AVG +
A 119V AVG +
B 120V AVG +
08:09:23

RESET

POWER ON 08:09:22 3-5a2

A 109V AVG +
08:13:17

A 104V AVG - 3-5d4
08:13:10

A 109V AVG -
08:13:02

A 114V AVG -
08:12:54

A 119V AVG -
08:12:47

A 124V AVG -
08:12:42

A 123V AVG -
08:12:39

A 134V AVG -
08:12:34

A 139V AVE +
08:12:24

A 134V AVE +
08:12:19

A 123V AVG +
08:12:11

A 124V AVG +
08:12:05

A 119V AVG +
08:11:50

A 116V AVG +
08:11:46

A 113V AVG +
08:11:41

A 110V AVG +
08:11:37

A 107V AVG -
08:11:31

A 0116V IMPULSE
02:18:12

A 0072V IMPULSE
08:18:05

A 035V AVG -
A 052V AVG -
A 068V AVG -
A 086V AVG -
A 104V AVG -
3-5d2 08:17:36

0012 CYCLES
A 130V SURGE
08:16:03

0012 CYCLES
A 109V SAG
08:15:59

0015 CYCLES
A 125V SURGE
08:15:37

0014 CYCLES
A 113V SAG
08:15:33

0003 CYCLES
A 122V SURGE
08:15:10

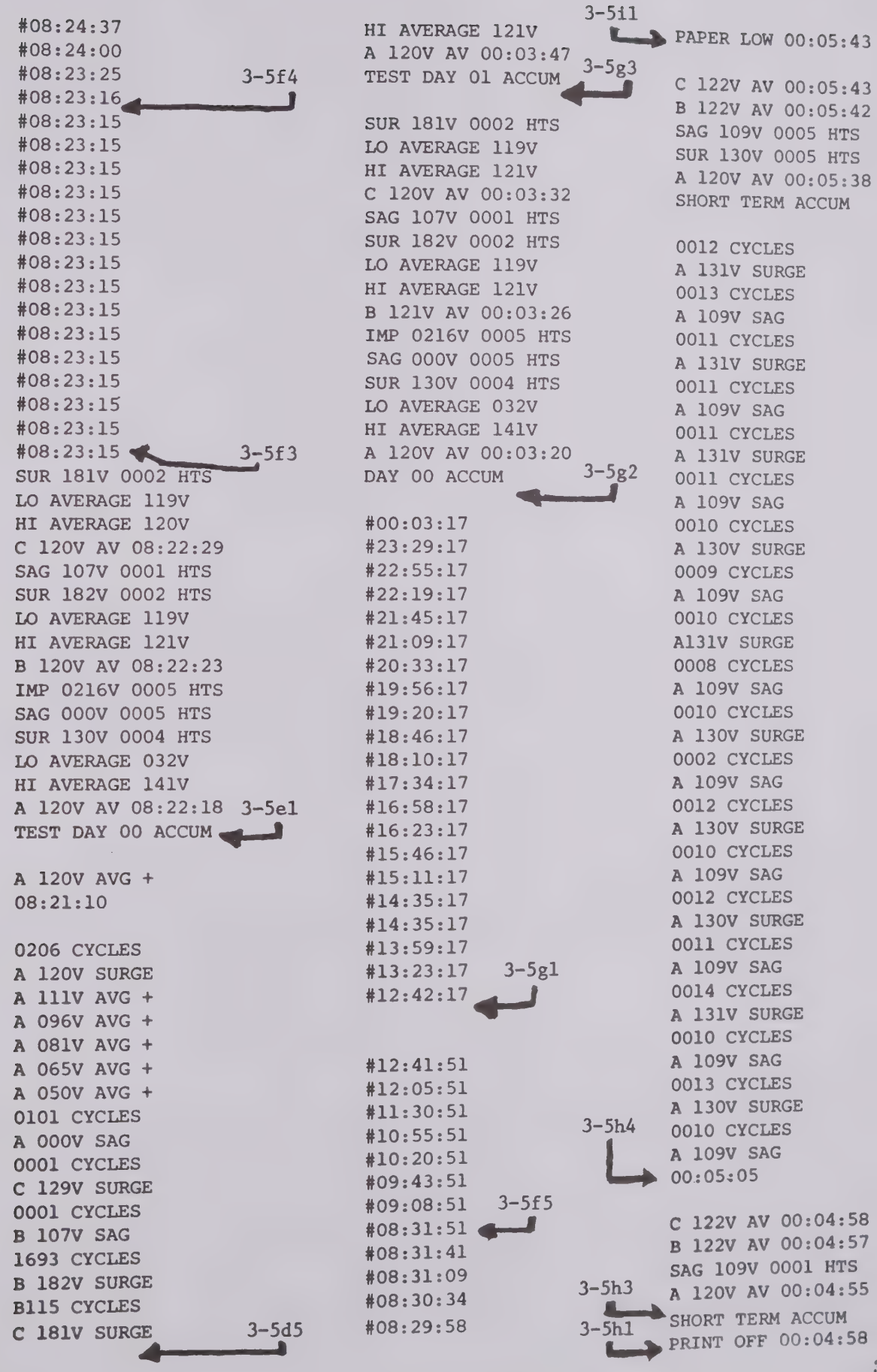
0004 CYCLES
A 117V SAG
0010 CYCLES
A 117V SAG
3-5c2 08:15:03

A 119V AVG +
08:14:35

A 109V AVG -
08:14:09

A 119V AVG -
08:13:56

A 129V AVG +
08:13:42


#08:24:37
#08:24:00
#08:23:25
3-5f4
#08:23:16
#08:23:15
#08:23:15
#08:23:15
#08:23:15
#08:23:15
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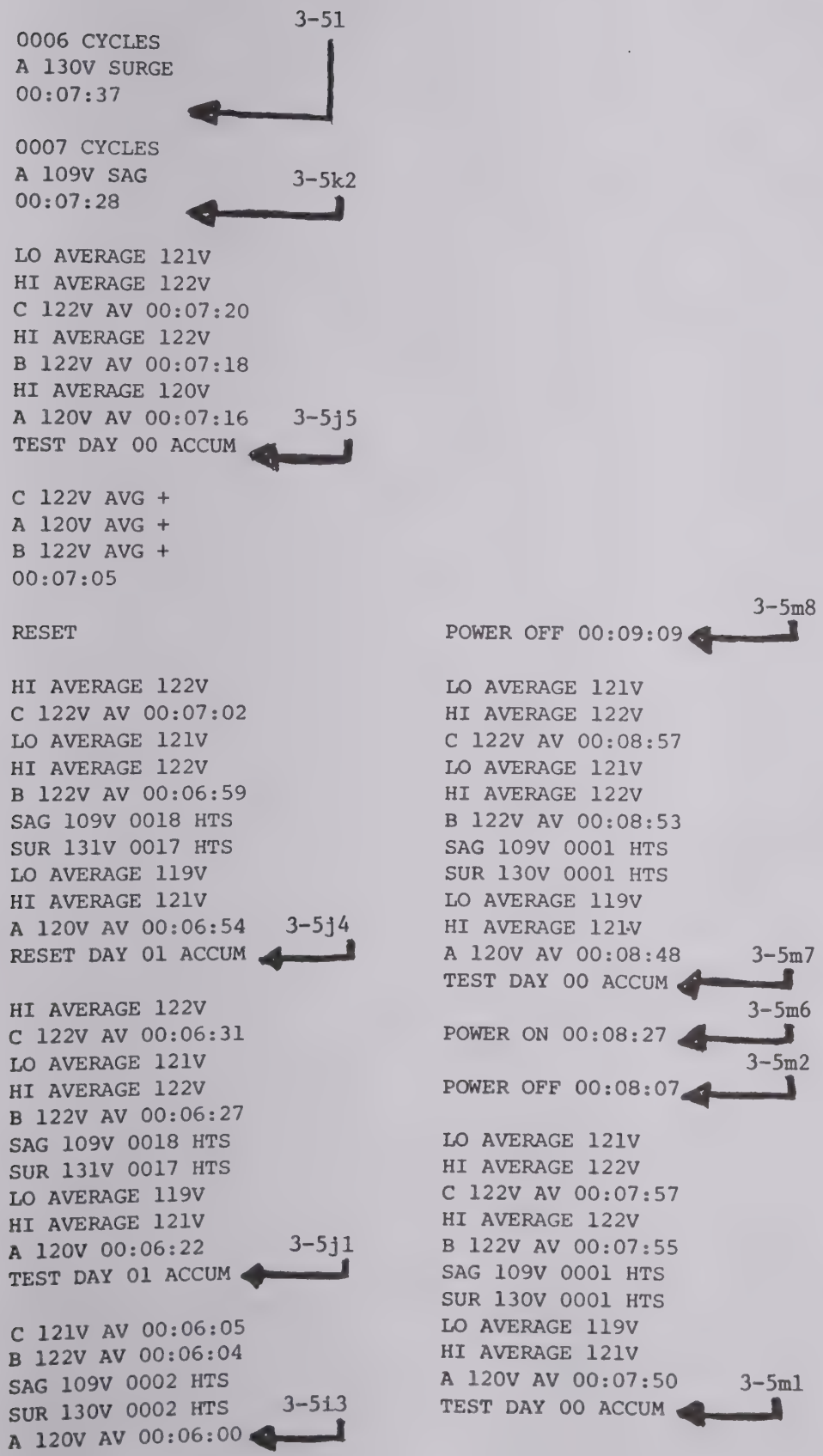
#08:23:15
#08:23:15
#08:23:15
#08:23:15
#08:23:15
#08:23:15
#08:23:15
3-5f3
SUR 181V 0002 HTS
LO AVERAGE 119V
HI AVERAGE 120V
C 120V AV 08:22:29
SAG 107V 0001 HTS
SUR 182V 0002 HTS
LO AVERAGE 119V
HI AVERAGE 121V
B 120V AV 08:22:23
IMP 0216V 0005 HTS
SAG 000V 0005 HTS
SUR 130V 0004 HTS
LO AVERAGE 032V
HI AVERAGE 141V
A 120V AV 08:22:18
3-5e1
TEST DAY 00 ACCUM
A 120V AVG +
08:21:10
0206 CYCLES
A 120V SURGE
A 111V AVG +
A 096V AVG +
A 081V AVG +
A 065V AVG +
A 050V AV G +
0101 CYCLES
A 000V SAG
0001 CYCLES
C 129V SURGE
0001 CYCLES
B 107V SAG
1693 CYCLES
B 182V SURGE
B115 CYCLES
C 181V SURGE
3-5d5
HI AVERAGE 121V
A 120V AV 00:03:47
TEST DAY 01 ACCUM
3-5g3
SUR 181V 0002 HTS
LO AVERAGE 119V
HI AVERAGE 121V
C 120V AV 00:03:32
SAG 107V 0001 HTS
SUR 182V 0002 HTS
LO AVERAGE 119V
HI AVERAGE 121V
B 121V AV 00:03:26
IMP 0216V 0005 HTS
SAG 000V 0005 HTS
SUR 130V 0004 HTS
LO AVERAGE 032V
HI AVERAGE 141V
A 120V AV 00:03:20
DAY 00 ACCUM
3-5g2
#00:03:17
#23:29:17
#22:55:17
#22:19:17
#21:45:17
#21:09:17
#20:33:17
#19:56:17
#19:20:17
#18:46:17
#18:10:17
#17:34:17
#16:58:17
#16:23:17
#15:46:17
#15:11:17
#14:35:17
#14:35:17
#13:59:17
#13:23:17
3-5g1
#12:42:17
#12:41:51
#12:05:51
#11:30:51
#10:55:51
#10:20:51
#09:43:51
#09:08:51
3-5f5
#08:31:51
#08:31:41
#08:31:09
#08:30:34
#08:29:58
3-5i1
PAPER LOW 00:05:43
C 122V AV 00:05:43
B 122V AV 00:05:42
SAG 109V 0005 HTS
SUR 130V 0005 HTS
A 120V AV 00:05:38
SHORT TERM ACCUM
0012 CYCLES
A 131V SURGE
0013 CYCLES
A 109V SAG
0011 CYCLES
A 131V SURGE
0011 CYCLES
A 109V SAG
0011 CYCLES
A 131V SURGE
0011 CYCLES
A 109V SAG
0010 CYCLES
A 130V SURGE
0009 CYCLES
A 109V SAG
0010 CYCLES
A131V SURGE
0008 CYCLES
A 109V SAG
0010 CYCLES
A 130V SURGE
0002 CYCLES
A 109V SAG
0012 CYCLES
A 130V SURGE
0010 CYCLES
A 109V SAG
0012 CYCLES
A 130V SURGE
0011 CYCLES
A 109V SAG
0014 CYCLES
A 131V SURGE
0010 CYCLES
A 109V SAG
0013 CYCLES
A 130V SURGE
3-5h4
0010 CYCLES
A 109V SAG
00:05:05
C 122V AV 00:04:58
B 122V AV 00:04:57
SAG 109V 0001 HTS
A 120V AV 00:04:55
3-5h3
SHORT TERM ACCUM
3-5h1
PRINT OFF 00:04:58


3-51
0006 CYCLES
A 130V SURGE
00:07:37
0007 CYCLES
A 109V SAG
3-5k2
00:07:28
LO AVERAGE 121V
HI AVERAGE 122V
C 122V AV 00:07:20
HI AVERAGE 122V
B 122V AV 00:07:18
HI AVERAGE 120V
A 120V AV 00:07:16
3-5j5
TEST DAY 00 ACCUM
C 122V AVG +
A 120V AVG +
B 122V AVG +
00:07:05
RESET
HI AVERAGE 122V
C 122V AV 00:07:02
LO AVERAGE 121V
HI AVERAGE 122V
B 122V AV 00:06:59
SAG 109V 0018 HTS
SUR 131V 0017 HTS
LO AVERAGE 119V
HI AVERAGE 121V
A 120V AV 00:06:54
3-5j4
RESET DAY 01 ACCUM
HI AVERAGE 122V
C 122V AV 00:06:31
LO AVERAGE 121V
HI AVERAGE 122V
B 122V AV 00:06:27
SAG 109V 0018 HTS
SUR 131V 0017 HTS
LO AVERAGE 119V
HI AVERAGE 121V
A 120V 00:06:22
3-5j1
TEST DAY 01 ACCUM
C 121V AV 00:06:05
B 122V AV 00:06:04
SAG 109V 0002 HTS
SUR 130V 0002 HTS
3-5i3
A 120V AV 00:06:00
3-5m8
POWER OFF 00:09:09
LO AVERAGE 121V
HI AVERAGE 122V
C 122V AV 00:08:57
LO AVERAGE 121V
HI AVERAGE 122V
B 122V AV 00:08:53
SAG 109V 0001 HTS
SUR 130V 0001 HTS
LO AVERAGE 119V
HI AVERAGE 121V
A 120V AV 00:08:48
3-5m7
TEST DAY 00 ACCUM
3-5m6
POWER ON 00:08:27
3-5m2
POWER OFF 00:08:07
LO AVERAGE 121V
HI AVERAGE 122V
C 122V AV 00:07:57
HI AVERAGE 122V
B 122V AV 00:07:55
SAG 109V 0001 HTS
SUR 130V 0001 HTS
LO AVERAGE 119V
HI AVERAGE 121V
A 120V AV 00:07:50
3-5m1
TEST DAY 00 ACCUM

APPENDIX A

TYPICAL DISTURBANCES AND MODEL 606 RESPONSES

A-1. INTRODUCTION

This section presents a number of disturbances that might be applied to a Model 606 Line Disturbance Analyzer, ranging from a single half-cycle dropout to a multiple sag/surge disturbance. Typical printouts for each type of disturbance are shown and each is described. Note that some of these disturbances are greatly exaggerated for clarity.

A-2. SINGLE HALF-CYCLE DROPOUT

Figure A-1A shows the input waveform of a 115V RMS line having a single half-cycle dropout. Since the Model 606 measures sags and surges over a full cycle, the sag/surge cycle detector will measure a single 57V RMS cycle and provide the printout shown. If the dropout were partial, the voltage reading would fall between 57V and 115V.

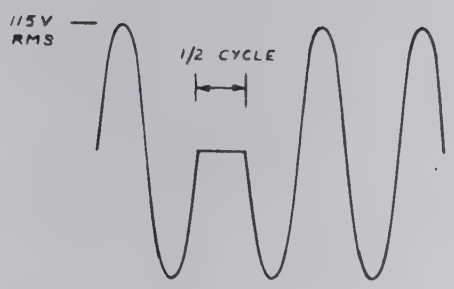
A-3. FULL-CYCLE DROPOUTS FROM 1 TO 15 CYCLES

If the input drops out for a number of cycles up to (approximately) 15, the sag/surge detector will measure zero volts over at least one complete cycle, and the cycle counter will count the number of cycles for which the voltage was at least one threshold value from the average voltage. The printout will be as shown in figure A-1B and will indicate the number of cycles for which low voltage was measured.

A-4. DROPOUTS OF 16 OR MORE CYCLES

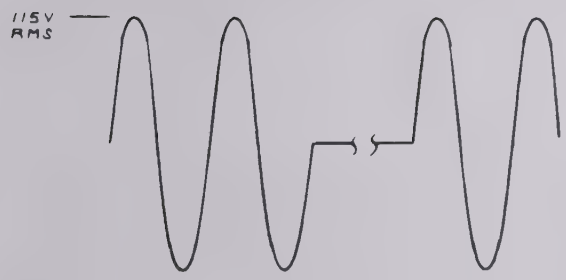
Figure A-1C shows the input voltage envelope, and the resultant printout for a 16 cycle dropout. In this case the averaging detector output has changed by the 3 volt threshold, so that:

1) A 112V AVG printout occurs.
2) A surge to 115 volts is measured (with respect to the 112V AVG) when the voltage recovers from the dropout.



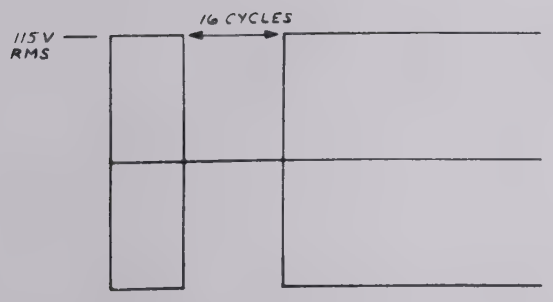
0001 CYCLE
57V SAG
00:12:01

A. 1/2 Cycle Dropout



0001 CYCLES
000V SAG
00:12:01
} UP TO 15 CYCLES

B. 1 Cycle to 15 Cycle Dropouts



0003 CYCLES
115V SURGE
115V AVG+
16 CYCLES
000V SAG
112V AVG
00:12:01

C. 16 Cycle Dropout

Figure A-1. Effect of Cycle Dropouts

A-5. REPETITIVE DROPOUTS

If the time between repetitive dropouts is long enough for the averaging detector output to recover fully, the results for each dropout will be the same as given above, until the internal memory fills up and the "short term accumulate" mode is entered. If the time between dropouts is short, a combination of SAG, SURGE, AVG, and short term ACCUM printouts will occur.

A-6. LONG SAGS

The sag/surge detector output is continually compared by the Model 616 processor to the long-term average output of the averaging detector. This averaging detector has a time constant* of approximately 3 seconds, and results in a settling time* of approximately 10 seconds.

If a long sag occurs, such as is shown in figure A-2, the cycle detector immediately detects the new voltage (176 volts in Figure A-2A). The averaging detector output starts to change immediately, and approaches the new voltage slowly. As soon as the difference between the averaging detector output and the cycle detector output exceeds the sag/surge threshold (3 volts in figure A-2(B), the cycle counter is started. From figure A-2B, it is evident that this will occur at the start of the disturbance at t=0. As long as the difference remains greater than the threshold, cycles will be counted.

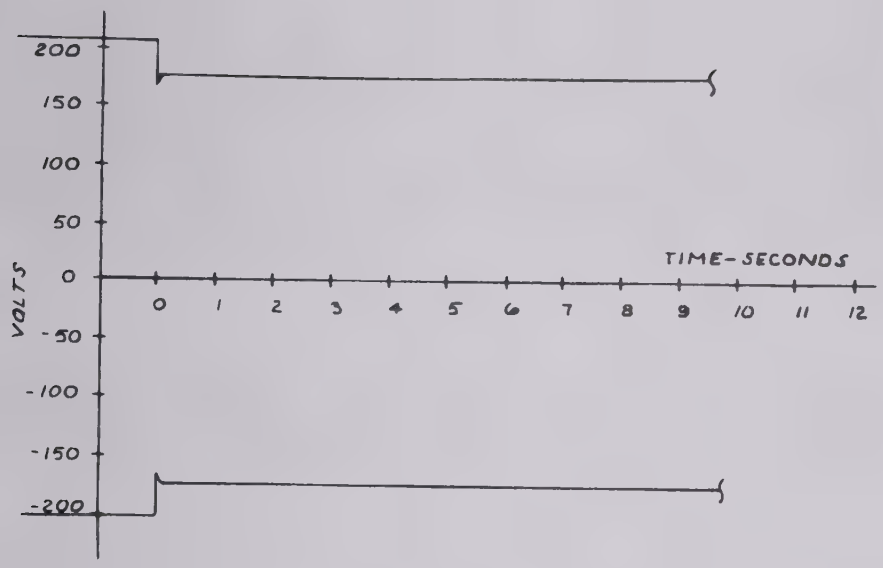
---

* Time Constant

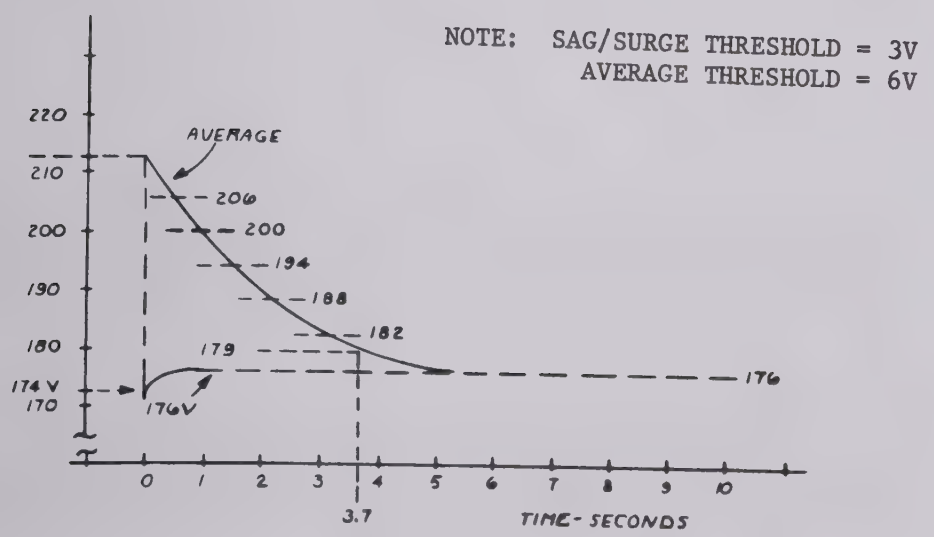
The "time constant" of the response of a network is defined, in terms of a simple exponential characteristic, as the time required for the output response to a step function input to change by $(1 - 1/\epsilon)$; approximately 63%. This definition is usually extended to include all monotonic response functions.

Settling Time

The "settling time" of a network, system or instrument is defined as the time required for the output response, or indication, to differ from the final value by less than the rated maximum error. When no rated maximum is specified, 1% is usually used to define "settling time."



A. Input Disturbance-Long Sag



B. Average Detector Output-Long Sag

Figure A-2. Typical Disturbance-Long Sag

While the cycles are being counted, the output of the averaging detector changes from the initial voltage (212V in figure A-2B) to the final voltage (176V in figure A-2B) following a response curve which has a time constant of approximately 3 seconds. Each time the averaging detector output changes by the threshold value (6 volts in figure A-2B), a new "average" value is printed. Thus new averages will be printed, for the disturbance of figure A-2, at 206V, 200V, 194V, 188V, 182V, and finally, at 176V.

When the output of the averaging detector reaches 179 volts, at about 3.7 seconds, the sag/surge detector concludes that the sag is over. This response occurs because a sag is defined as the condition in which the difference between the outputs of the cycle detector and the averaging detector exceeds the threshold value (3 volts, in this case). For this reason, the cycle count will stop at 3.7 seconds and a SAG printout will occur.

Figure A-3 shows the disturbance of figure A-2 in more detail and the printout which results. During the time that the cycle counter is active (i.e., while the difference in sag/surge and slow average is greater than 6 volts RMS), there will be no sag/surge printout. However, as indicated above, as the output of the averaging detector changes by the threshold value, average printouts will occur (after temporary storage in the memory). When the cycle count stops (at 3.7 seconds, in this case), the lowest sag voltage (174 volts) and cycle count (222 cycles) will be printed. After this, any further average changes (only 176V in this case) will be printed.

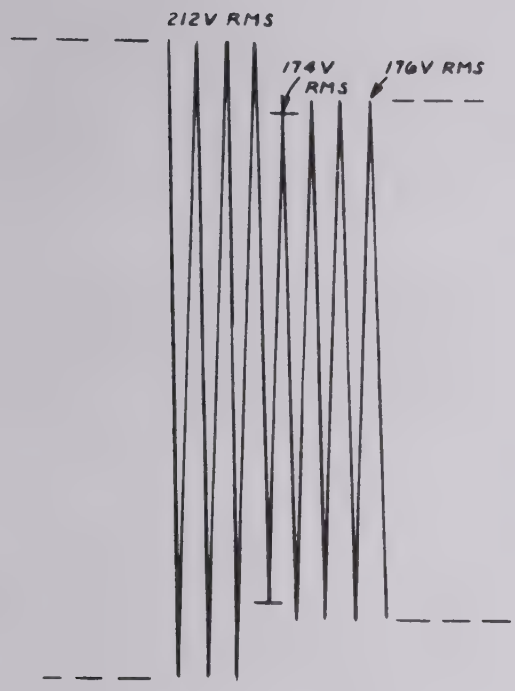
This interaction between the averaging detector and the sag/surge detector will occur any time a sudden change in voltage occurs of sufficient magnitude and duration to affect the averaging detector. This will be shown in the following examples.

A-7. SHORT SAG, LONG SURGE, LONG SAG

Figure A-4 shows a disturbance consisting of a short sag from 176V to 136V for 6 cycles, a surge to 212V for 12 seconds, and a long sag back to 176 volts. The resulting printout is shown below, and it follows the disturbance in the following manner.

The initial sag, lasting 6 cycles, is detected at 11:00:08. During this time the averaging detector output changes by less than the threshold setting (6 volts) so that only the sag is detected and recorded.

The surge to 212 volts is detected by the cycle detector, and the cycle count is started. During the 12 seconds, the output of the averaging detector increases (analagous to the average change in par. A-6) and average printouts occur each time the output changes by 6 volts. When the difference between



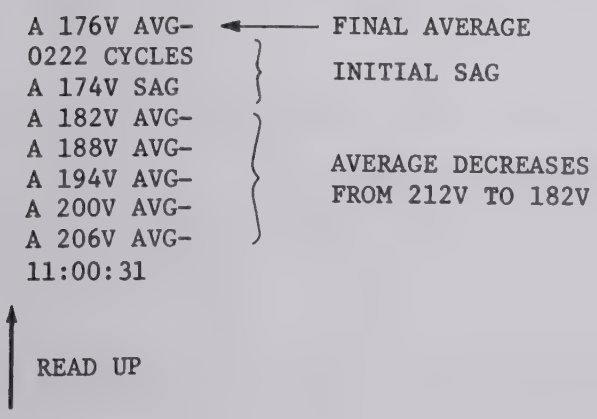
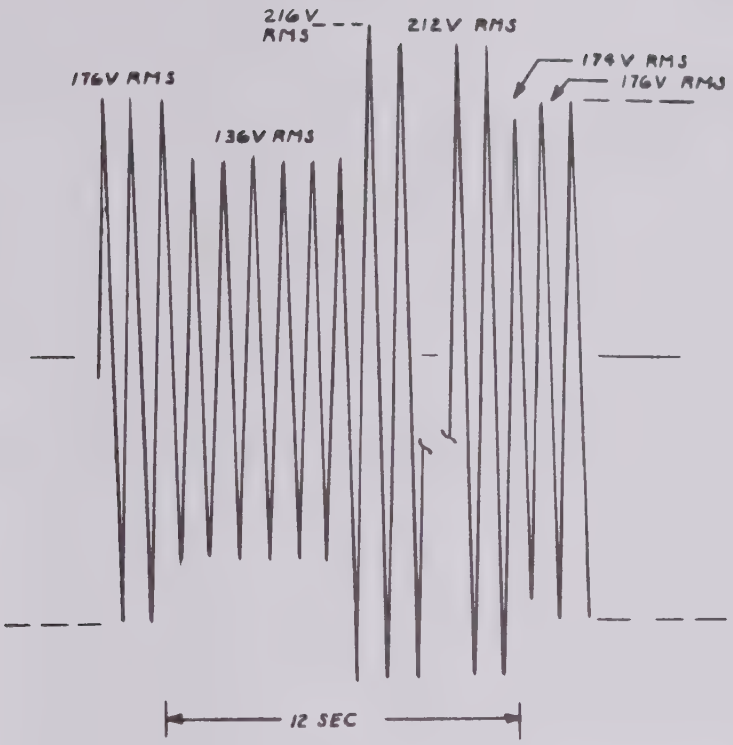


Figure A-3. Model 606 Response to Long Sag



A 176V AVG-
0222 CYCLES
A 174V SAG

SAG TO 174V AT 12 SEC

A 182V AVG-
A 188V AVG-
A 194V AVG-
A 200V AVG-
A 206V AVG-
11:00:31

AVERAGE DECREASES FROM 212V TO 176V

0208 CYCLES
A 216V SURGE

INITIAL SURGE TO 216V CYCLES COUNTED FOR 3-1/3 SEC

A 212V AVG+
A 206V AVG+
A 200V AVG+
A 194V AVG+
A 188V AVG+
A 182V AVG+

12 SEC AT 212V. AVERAGE INCREASES FROM 176V TO 212V

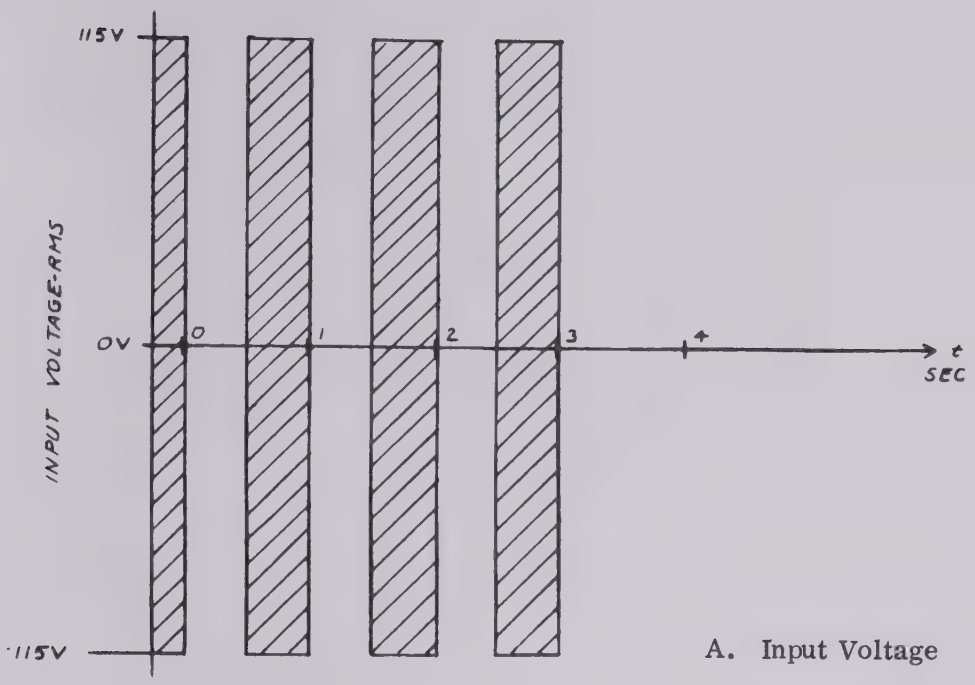
0006 CYCLES
A 136V SAG

6 CYCLES AT 136V

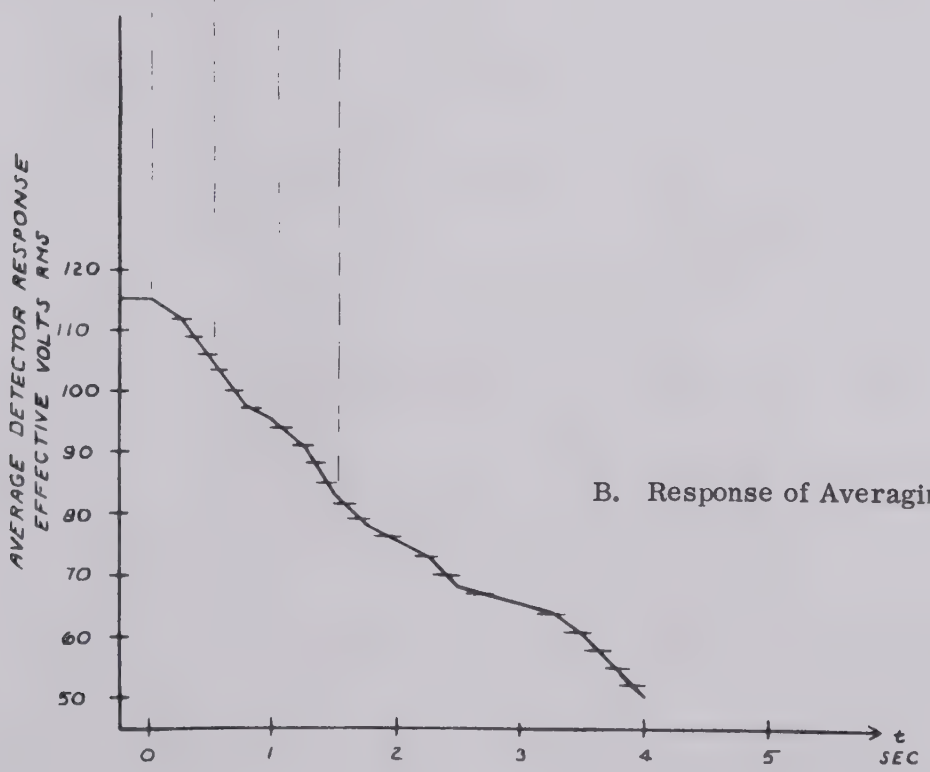
11:00:08

READ UP

Figure A-4. Complex Disturbance



A. Input Voltage



B. Response of Averaging Detector

Figure A-5. Effects of Repeated Dropouts (Sheet 1 of 2)

```
C 001V AV 00:13:48
SAG 000V 0001 HTS
SUR 115V 0001 HTS
LO AVERAGE 032V
B 000V AV 00:13:43
A 115V AV 00:13:42
FREQ 060.0HZ
SHORT TERM ACCUM <------ MEMORY FULL

B 075V AVG-
B 079V AVG-
0029 CYCLES
B 115V SURGE          SECOND
B 082V AVG-           RECOVERY
B 085V AVG-
0029 CYCLES
B 000V SAG            SECOND
B 088V AVG-           DROPOUT
B 091V AVG-
B 094V AVG-
B 097V AVG-
0027 CYCLES
B 116V SURGE          FIRST
B 100V AVG-           RECOVERY
B 103V AVG-
0033 CYCLES
B 000V SAG            FIRST
B 106V AVG-           DROPOUT
B 109V AVG-
B 112V AVG-
00:13:22
```

C. Typical Printout for Alternating Sags and Surges (Average Threshold at 3V)

Figure A-5. Effects of Repeated Dropouts (Sheet 2 of 2)

the sag/surge detector and averaging detector output falls to less than 3 volts (the sag/surge threshold) the cycle counter stops and the surge to 216 volts for 208 cycles is recorded.

At the end of 12 seconds, a sag from 212V to 176V is experienced. This is detected and recorded exactly as in par. A-6 above.

A-8. ALTERNATING SAGS AND SURGES DUE TO REPEATED DROP-OUTS

A common occurrence during power system faults is a series of voltage dropouts and recoveries as the system attempts to recover from the fault. Figure A-5A shows the envelope of such a fault condition, consisting of drop-outs and recoveries at a 0.5 second rate. The averaging detector starts to respond to the changing input immediately, and the resulting averaging detector output is shown in figure A-5B. If the averaging detector threshold were set at 3 volts, printouts would be initiated at the points marked with a short horizontal bar. In addition, sag and surge cycle counts would occur as indicated in figure A-5A.

Figure A-5C is the printout which results from the input shown in figure A-5A. During the first "off" period, sag cycle counts are started and the average printouts occur each time the averaging detector output changes by the threshold (3 volts). When the input is turned "on" again, the sag cycle count is stopped and the surge cycle count is started. At this time the sag printout (000V) and the cycle count (0033 CYCLES) occur. An impulse may sometimes be recorded for this type of waveform because there may be a sudden change in instantaneous voltage which exceeds the impulse threshold.

The output of the averaging detector continues to drop but at a slower rate, so that fewer average printouts occur during the surge. When the input again goes "off," the surge cycle count stops and another sag count starts. The surge count is then printed out.

With this type of input disturbance, and with the threshold set at 6V or 3V, it is possible that the combination of average readings, sag/surge readings and (occasional) impulse readings may overload the internal real-time memory, which is capable of storing up to 15 different disturbances. If this occurs, the Model 616 will go into the "short-term accumulate" mode and will print out, as soon as the disturbances stop, the accumulated data for each type of disturbance.

APPENDIX B. INSTALLING PAPER TAPE IN ANALYZERS USING THERMAL PRINTER P/N 102889

B-1. INTRODUCTION

An earlier version of the Model 606 Analyzer is equipped with a different Thermal Printer than the later one shown in the body of this manual. The earlier printer may be easily identified by the presence of a paper advance knob. (See figure B-1.) When installing paper tape in such printers, refer to the instructions in the following pages.

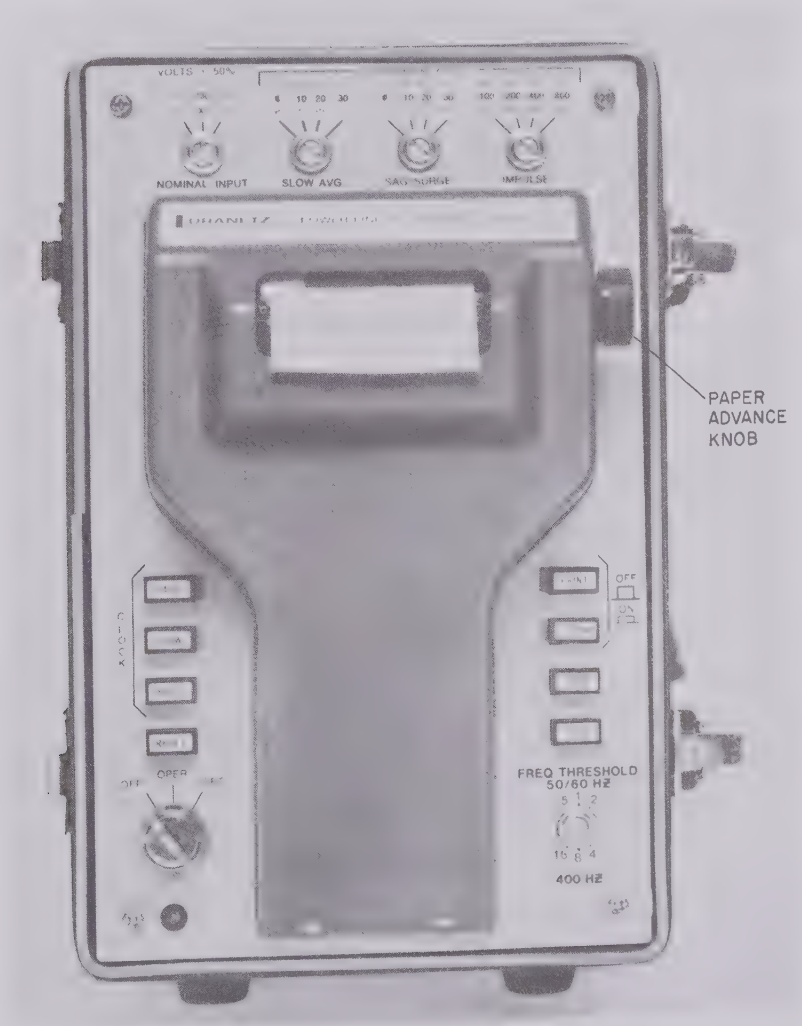


Figure B-1. Series 606 Analyzer Equipped with Thermal Printer Part No. 102889

B-2. INSTALLATION OF PAPER TAPE (See figure B-2.)

The Analyzer is shipped with a roll of paper already installed. During operation, when the paper supply becomes low, the unit will automatically print PAPER LOW (and operation will be shifted to the "PRINT OFF" mode) indicating that the paper roll should be replaced.

NOTE

In the "printer off" mode, normal printout of disturbance data is inhibited and only the daily accumulated summary is produced. Therefore, if it is anticipated that a large number of disturbances will occur during a period of unattended operation, do not wait for a PAPER LOW condition — install a full roll of paper.

Before replacing the thermally sensitive paper, clean the printhead as described in paragraph 2-12. After cleaning the printhead, replace the paper roll as follows:

a. Depress upper edge of paper and printer cover and lower cover as shown in figure B-2.

b. Tear paper roll just above old roll.

c. Rotate paper advance knob counterclockwise to advance remaining paper from printer.

d. Push two spring paper holders outward to release old paper roll and remove roll.

e. Remove holding tab from new paper roll to release end of roll. Use a scissors to cut the edge of the paper straight.

f. Holding the paper roll so that it unrolls as shown in figure B-2, expand the two spring paper holders, install the roll, then release the holders to lock the roll in place.

g. Feed the cut end of the roll into the opening under the printer, as shown, then slowly rotate the paper advance knob counterclockwise until the paper end comes into view.

CAUTION

To avoid damaging the printer, observe the following precautions:

1. Never turn the paper advance knob clockwise.
2. Never move or lift the printhead.

h. Lift the serrated plastic guide.

i. Rotate the paper advance knob counterclockwise until about 6 inches of paper extends from the printer.

j. Raise cover, guide paper tape through opening, then lock cover in place.

NOTE

Due to the coiling action of the paper on its spool, it is likely that repetitive printouts of the PAPER LOW message will occur until the paper supply is clearly below the triggering point of the optical paper sensors. This occurrence is intentional and should not be a cause for concern.

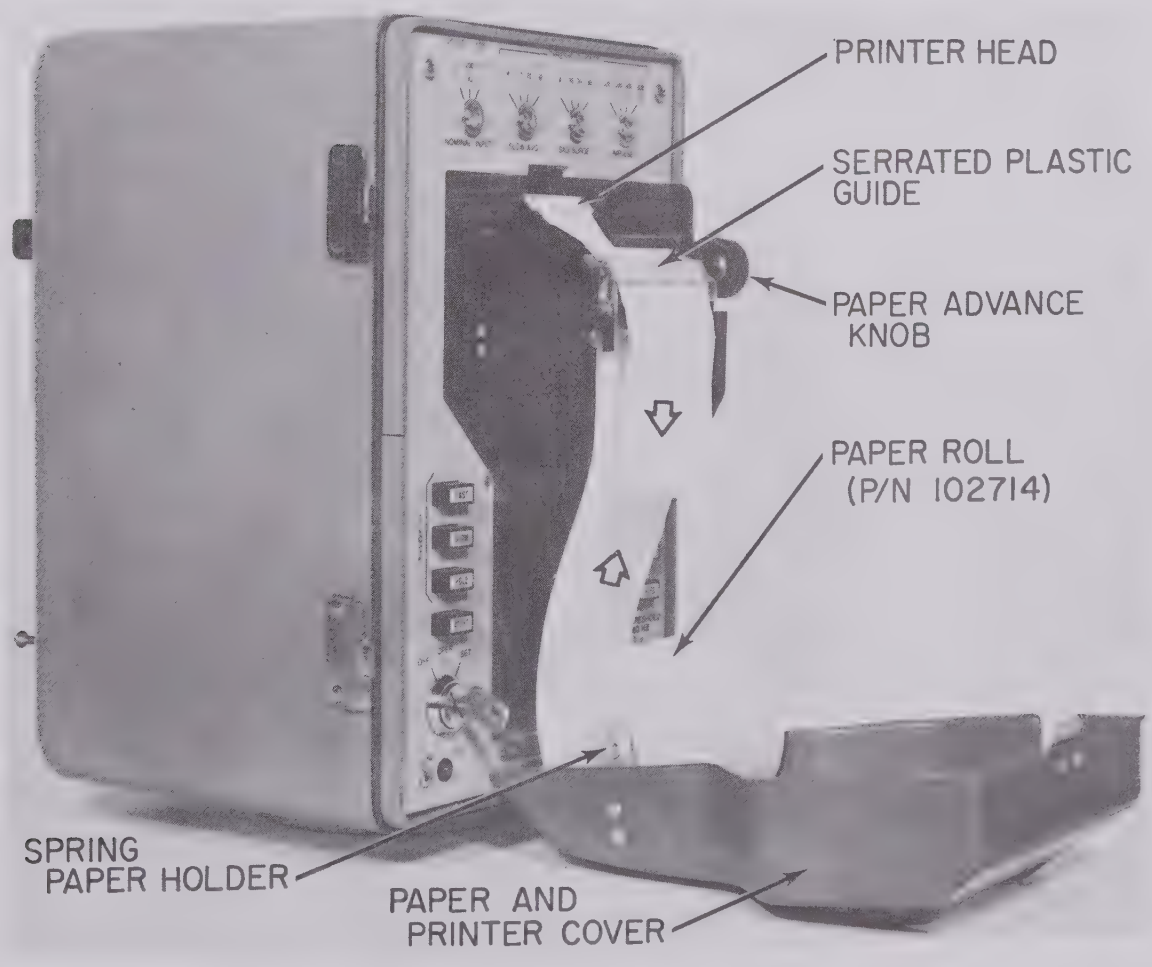


Figure B-2. Installing Paper Tape in Earlier Thermal Printers

Date of Issue: June 22, 1983

00908209

PRINTER PAPER REORDER FORM

The Series 606,616,626, SER System 22, TEA, 808, and 3100 use specially treated thermal paper. This paper (P/N 102, 714) is supplied direct from the factory by Dranetz Technologies, Inc. Use of non-approved suppliers is not recommended as possible damage to the printer could result.

To insure rapid handling of your order, Dranetz Technologies, Inc. has established two alternative plans for reordering printer paper. These are described below. Please check the plan you prefer and provide the necessary information. Return this form in the self-addressed envelope enclosed. Shipment will be within 48 hours of receipt of order.

STANDARD REORDER PLAN

Minimum quantity is 27 rolls.
Price is $3.15/roll.
FOB, destination, Continental U.S.
Send a purchase order specifying P/N 102, 714.
shipping address, and billing address, if
different.
You will be billed according to standard
Dranetz Technologies, Inc. procedures.

RAPID REORDER PLAN

Minimum quantity is 6 rolls
Quantity:_____rolls at $3.15/roll.
FOB Destination, Continental U.S.
Total payment enclosed $_____.
A check or money order in the above amount
must be enclosed.

Ship paper to:

_____

_____

_____

Prices above subject to change, confirm prices at time of order with Dranetz Plant Sales Department or designated representative.

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